A POTTER'S BOOK

Covered Stoneware Pot, 12th century. Either made by immigrant Chinese potters or under their influence. In the full fruit-like form of this fine pot and in the modified Sung brush work of the leaf pattern which enriches it the influence of a tropical environment may be clearly seen.

A POTTER'S BOOK

by

BERNARD LEACH

with introductions by

SOYETSU YANAGI

and

MICHAEL CARDEW

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I DEDICATE THIS BOOK
TO ALL POTTERS

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INTRODUCTION: LEACH IN JAPAN

By Soyetsu Yanagi

Director of the National Folk Museum, Tokyo

Most visitors from the West come to the East to teach or to criticize. We have learnt a good many things from the views of outsiders, but few people come over here to learn from our side, and still fewer are the foreigners who realize that we learn more from those who learn from us.

Enchanted with the memories of his childhood in the East, and fascinated by the magic of Lafcadio Hearn's prose, Leach came to Japan at the age of twenty-one, full of dreams and wonder. Trained as an artist, he had planned to give lessons in art; but the time soon came, as he once confessed to me, when he cast aside what he was intending to give and plunged into his new life, of receiving. This straightforward conversion gave him the rare chance of reaching the heart of the East from within. So it is not surprising that his influence on us has been so great, and that there has been between him and us a community and understanding such as has scarcely ever been reached before between ourselves and foreigners.

Fortunately his love for Japan was not the sentimental one so often met with, but an honest one, informed by the insight and imagination of an artist. It would seem that art is always the best highway for mutual understanding between different peoples.

At the time when he came to Japan our young artists were in

the midst of their 'Wanderjahre' in quest of artistic light. It was the period when the work of such artists as Rodin, Van Gogh and Cézanne were introduced for the first time in this country and made such a stir and sensation among us, playing an important part in the renewal of our cultural life. It was about thirty years ago; we were all young men at that time. I first met him one evening when he was giving a lecture in his new house in Tokyo, the first lecture ever given in Japan on the art of etching. He demonstrated the process with the big press which he had brought from England. I was one of the audience who listened to a talk in which the name of Augustus John was repeated over and over again. I remember the moment even now, when he showed us a fine pencil-drawing of a gypsy girl by John, which he afterwards presented to us.

After that I often met him again at an exhibition of modern Western art which was held in Tokyo. We were drawn to each other silently and irresistibly; I think we realized instinctively that our characters were necessary to each other.

From that time on he lived among us as one of us. Our spiritual appetites were the same, we moved about in an unknown world, looking for our real home. Our hope was his hope, and our agony was his agony. He probably got nearer to the heart of modern Japan than the ordinary Japanese did. It is doubtful whether any other visitor from the West ever shared our spiritual life so completely. Lafcadio Hearn was certainly one of these rare souls, but what he knew was the old Japan, whereas what Leach touched was the new Japan.

It was in this country that he learnt the art of making pottery. He began under the instruction of old Kenzan, a pottery master, the sixth of one of the well-known lines of Japanese traditional potters. Leach and later on his brother artist Tomimoto studied hard under the old man. Their efforts were rewarded. A 'Certificate of Proficiency' written on impressive *hōshō* paper was bestowed upon them by the master. Seeing that old Kenzan died without any heir, Leach and Tomimoto

should rightly receive the title of the seventh Kenzan, for they are the only pupils who legally mastered the art of Raku ware. This is a fact which might be of interest to students of Japanese ceramic history.

There followed other, more serious, studies for stoneware making. He fired at several potteries at different places, but worked for the most part at his own kiln, designed by Kenzan, at Abiko, and later in Tokyo. Here he made some very fine pieces in blue and white, in celadon, and in overglaze enamels.

Besides his work in Japan, his stay in China enabled him to deepen his views on ceramics; in particular, the wares of the Sung dynasty opened a new world. His visit to Korea also nourished his sense of that imaginative beauty which is so delicately manifested in the pottery of that solitary country.

I cannot forget the pleasant days when I lived with him in the quiet village of Abiko, by the side of a lagoon.

Abiko, about twenty-five miles from Tokyo, was at that time a colony of artists, and the centre of a literary school called *Shirakaba*. A number of artists and men of letters gathered here in exciting discussions and intimate appreciations. Leach talked well but also listened well. He was never idle, and I have never seen him tired. All his friends liked him, respected his work and learnt many things from his attitude towards art, and especially from his keen intuition for beauty.

During his stay in Japan he held exhibitions in Tokyo annually for several consecutive years, all of which were successful. Our people are born pottery lovers, for among us pottery making has been for centuries regarded as a true art, of equal dignity with the fine arts. Leach's etchings, drawings and pottery attracted many visitors and widened his fame year after year. Even after his return to England there has been a repeated demand for exhibitions of his work over here. Many Europeans may know more of the science or history of Oriental ceramics, but none, so far as I know, has ever before expressed the spirit of Far Eastern pottery in actual things.

He has his own sense of form and colour, but he is at his best in drawing, as may be seen from his tiles and slipware designs. As a maker of patterns he stands out as unique among modern craftsmen, for in the work of modern craftsmen (as opposed to those of the past) nothing is more striking than the lack of the intuitive ability to create patterns, a tendency which seems to be parallel with the lack of melody in modern music. Very few contemporary craftsmen are able to produce creative patterns with real vision and vitality in them. Leach's patterns are distinguished by their imaginative quality. They are full of poetry in which man and nature sing together rhythmically.

Leach is a man of humble and affectionate character, and what he makes is intimate and warm. He has never been an artist of repulsive and excessive character, the tragical symptom of the so-called modernism. It is not surprising that Korean pottery stimulated his work more strongly than anything else. His art is more naturally akin to Korean work than to Chinese or Japanese.

Yet he is not a sentimentalist; his taste, as I understand him, is rather for the austere Gothic than the sweet Greek. In this sense he is a true descendant of William Blake, whom he admires above any other English artist. He is probably the only living English potter who carries on the tradition of Toft and Simpson and the slipware of the seventeenth century.

But above all, the outstanding character of his work is the union in it of East and West. All his ideas, life and endeavour seem to have been focussed on this one point. An Englishman by blood, born in China, educated in London, who learned his art in Japan and now works in England, he feels this union to be the special task of his life. Owing to the special circumstances of his life he knows both hemispheres from within, and this gives him an unique and unprecedented position as an artist. If the meeting of East and West be a cherished human ideal, then his aims and achievements in art should be honoured by the discerning, although it be only the beginning of an endless

journey. We in Japan feel him to be a brother, not a stranger at all, for ours is destined to be the country where, as modern history shews, new and old, high and low, East and West, make their contact day by day. We feel that we in particular were born to solve this problem in some way or other, though in this age of disintegration and divorce in so many directions, it is a task in which the peoples of all nations must collaborate.

May I quote here a Buddhist quatrain, which every Japanese pilgrim carries with him wherever he goes:

Really there is no East, no West,
Where then is the South and the North?
Illusion makes the world close in,
Enlightenment opens it on every side.

SOYETSU YANAGI

PREFACE

By Michael Cardew

This is a practical book for those potters who work as artists, either in one-man studios or in small workshops.

But it is much more than that: it should be of great use also to the numbers of people who, although not necessarily craftsmen, are interested in pottery, whether in commerce and manufacture, as teachers, as collectors, or simply as intelligent consumers. In recent years there has been a great, even a surprising, increase in the numbers of studio potters in England, and there has grown up a Modern School of pottery, an essential element in which is the gradual creation of a new relationship between the potter and his public, very different from that of the past, when the 'mysteries' and 'secrets' of the trade were guarded jealously. In this atmosphere the public, kept in a state of genteel ignorance about the mechanical arts, expected to be flattered or astonished by aesthetic novelty and technical skill. It is not surprising that this state of affairs produced a marked reaction to the modern ideal of a sympathetic understanding of the potter's technical means and artistic aims; and this book is an important contribution to the building-up of such an understanding. The technical means, the alleged 'secrets' of the old potters of China and Japan were, as Mr Leach shows so admirably, a very simple and perfectly homely use of their natural materials and resources: their real secret lay in the integral tradition, the continuity of their culture. There is no

need to complain that the tradition is lost and the continuity broken: it is only necessary for the modern potter to set to work in the same spirit, using the same kind of materials in a straightforward and natural way.

The complaint is sometimes made that studio potters, especially in England, appear to be slavish followers of the early Chinese. Certainly they emulate the early Chinese potters, and they are quite right to do so; but in fact they do not follow them so slavishly as the potters of the sixteenth century, when Chinese porcelain was first imitated in Europe. Then, and for a century or more following, the whole main stream of European ceramics was directed to imitating the achievements of the later Chinese porcelain of the Ming period. But in fact potters of most ages have looked to the Chinese as their masters. The Persians and Arabs of the early Middle Ages did the same thing, striving to imitate and equal the celadons which were being exported at that time to the Mohammedan world.

No apology is necessary for the modern potter if he does the same thing in a mode appropriate to modern times, and no apology need be made for the fact that the methods of China and Japan occupy so much space in this book. On the contrary, the fact that Mr Leach has lived and worked for so long in Japan as well as in England, is his best qualification for writing it.

MICHAEL CARDEW

AUTHOR'S PREFACE

Pottery has its own language and inherent laws, and words have theirs, and neither can be bound by the other. Nevertheless a certain amount of translation and interpretation is possible provided a potter can find the words, or a writer insight into pottery. I have been fortunate in having had the aid of such a writer; any clarity of expression which may have been achieved is due in great measure to my friend Henry Bergen.

This book is the outcome of twenty-eight years' experience of making pots by hand processes in the Far East and in England. During twelve of those years I had unique opportunities of gaining an insight into the spirit and methods by which early Oriental pottery was made. Here I have attempted to state these simply and openly, and to relate them to our Western need, primarily for the sake of other potters who suffer inevitably from the almost entire loss of our own birthright of traditional craft lore. But this book is also intended for students and teachers, for lovers of good pots and sound craftsmanship, and finally for those to whom the cultural meeting of East and West is the prelude to a human society. Out of my dual experience I have tried to formulate a criterion by which good pots may be recognized in a manner similar to that by which an ever-changing but nevertheless continuous classic standard encourages the appreciation of fine architecture, painting, writing and music. Accepting the qualities of the pottery of the T'ang and Sung dynasties as the height of ceramic beauty, I have reviewed and

revalued much which has long been taken for granted. My frequent criticism of mass-produced wares should not be regarded as an attack upon the machine so much as an exposure of the false standards of beauty, whether of commercial origin or of debased court taste, which have accompanied the rise of industrialism.

As the main technical chapters are based very largely upon personal experience many types of pottery are omitted, but between Japanese raku, English slipware, stoneware and porcelain a fairly representative field is covered. I have endeavoured to explain principles as well as to describe practice in order to enable students of pottery to adapt recipes of glazes and pigments, and designs of kilns, to local conditions. Much attention has been given to the inherent qualities of raw material, and whenever possible European substitutes have been suggested for Oriental. Certain types of pots, such as Chinese blue and white porcelain, will not be found amongst the illustrations because they are sufficiently well known: others, such as enamelled wares, because of the expense of colour reproduction, and only eight contemporary potters are represented. I regret the disproportionate number of photographs of my own pots, but I have been forced to use them by the difficulty of otherwise obtaining suitable illustrations of many of the processes described in the text.

Dartington, 1939

ACKNOWLEDGMENTS

Without the help of Leonard and Dorothy Elmhirst I would never have been able to find time to disentangle years of pottery notes and to gather and organize the other material which has gone to the making of this book. To them my first thanks are due.

To Henry Bergen, Ph.D., I am deeply indebted for constant revision and many details of fact.

My former pupils, Michael Cardew, Laurie Cookes and Katharine Pleydell-Bouverie, have contributed in various ways with generous criticism, typing, notes and photographs.

The analyses of wood ashes on p. 162 are the result of repeated experiments undertaken by the Dartington Hall Laboratory under J. B. E. Patterson, M.Sc., A.I.C.

What I owe to friends in Japan, my old master Ogata Kenzan, K. Tomimoto, S. Yanagi, S. Hamada, K. Kawai and many others cannot be measured in words.

To the courtesy of the Victoria and Albert and British Museums permission to reproduce a large number of the illustrations is due.

Chapter I

TOWARDS A STANDARD

Very few people in this country think of the making of pottery as an art, and amongst those few the great majority have no criterion of aesthetic values which would enable them to distinguish between the genuinely good and the meretricious. Even more unfortunate is the position of the average potter, who without some standard of fitness and beauty derived from tradition cannot be expected to produce, not necessarily masterpieces, but even intrinsically sound work.

The potter is no longer a peasant or journeyman as in the past, nor can he be any longer described as an industrial worker: he is by force of circumstances an artist-craftsman, working for the most part alone or with a few assistants. Factories have practically driven folk-art out of England; it survives only in out of the way corners even in Europe, and the artist-craftsman, since the day of William Morris, has been the chief means of defence against the materialism of industry and its insensitivity to beauty.

Here at the very beginning it should be made clear that the work of the individual potter or potter-artist, who performs all or nearly all the processes of production with his own hands, belongs to one aesthetic category, and the finished result of the operations of industrialized manufacture, or mass-production, to another and quite different category. In the work of the potter-artist, who throws his own pots, there is a unity of design and execution, a co-operation of hand and undivided personal-

ity, for designer and craftsman are one, that has no counterpart in the work of the designer for mass-production, whose office is to make drawings or models of utensils, often to be cast or moulded in parts and subsequently assembled. The art of the craftsman, to use Herbert Read's terminology, is intuitive and humanistic (one hand one brain); that of the designer for reduplication, rational, abstract and tectonic, the work of the engineer or constructor rather than that of the 'artist'. Each method has its own aesthetic significance. Examples of both can be good or bad. The distinction between them lies in the relegation of the actual making not merely to other hands than those of the designer but to power driven machines. The products of the latter can never possess the same intimate qualities as the former, but to deny them the possibility of excellence of design in terms of what mechanical reproduction can do is both blind and obstinate. A motor car such as a Rolls Royce Phantom achieves a kind of perfection although its appeal is mainly intellectual and material. There I think we come to the crux of the matter: good hand craftsmanship is directly subject to the prime source of human activity, whereas machine crafts, even at their best, are activated at one remove—by the intellect. No doubt the work of the intuitive craftsman would be considered by most people to be of a higher, more personal, order of beauty; nevertheless, industrial pottery at its best, done from the drawings of a constructor who is an artist, can certainly have an intuitive element.[1] The trouble, however, is that at a conservative estimate about nine-tenths of the industrial pottery produced in England no less than in other countries is hopelessly bad in both form and decoration. With the exception of a few traditional shapes and patterns for table-ware, and others designed by the best designers available to-day and painted by the best available artists (none of whom is a potter), turned out

[1] 'Whenever the final product of the machine is designed or determined by anyone sensitive to formal values, that product can and does become an abstract work of art in the subtler sense of the term.' —Read, *Art and Industry*, p. 37.

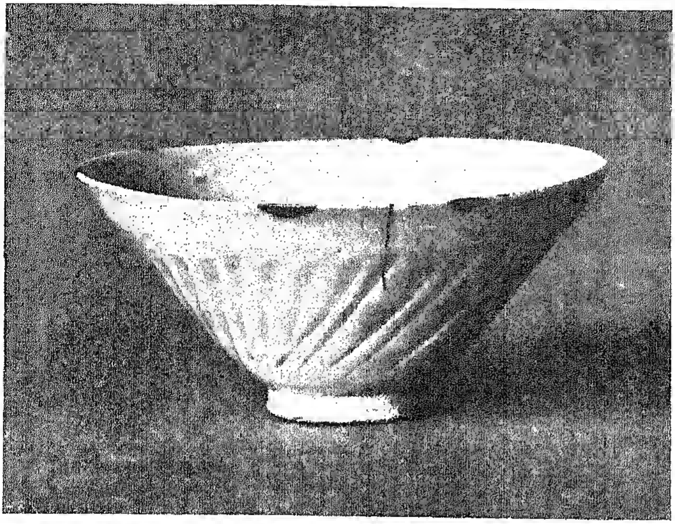
notably by the Wedgwood and Royal Worcester and Minton factories and by the Makin and Gray firms in Hanley, and excluding also a few purely functional and utilitarian designs, some of which are also traditional, such as Doulton's acid-jars, we meet everywhere with bad forms and banal, debased, pretentious decoration—qualities that are perhaps most conspicuous in 'fancy vases', flower-pots and other ornamental pieces, in which we find a crudity of colour combined with cheapness and inappropriateness of decoration and tawdriness of form that must be seen to be believed. And although the mechanical processes are indeed marvellous, as for example the automatic glazing, cleaning, measuring and stamping of many millions per month of bathroom tiles, fired in a single non-stop tunnel kiln, the mere fact of their being mass-produced is no reason why these tiles should be as cheaply designed and as dull and miserable in colour as it is possible for tiles to be; nor in the case of hollow-ware is the casting of shapes so exactly and so quickly and with such perfect pastes an adequate excuse for dead shapes, dead clay, dead lithographed printing or the laboured painting of dead patterns. Indeed the more elaborate and expensive the decoration the more niggling and lifeless it is, and the nearer it approaches the long deceased fashion of naturalism of the nineteenth century, when close attention to detail and the careful painting of pictures upon porcelain in enamel colours was considered the summit of ceramic art—'applied' art with a vengeance! On the other hand, if the bulk of the pottery turned out in England to-day is mass-produced and of inferior form and decoration, its inferiority is not so much due to the manner of its production—for mass-produced wares can not only be of fine quality of body[1] and beautiful in form, if designed by the right

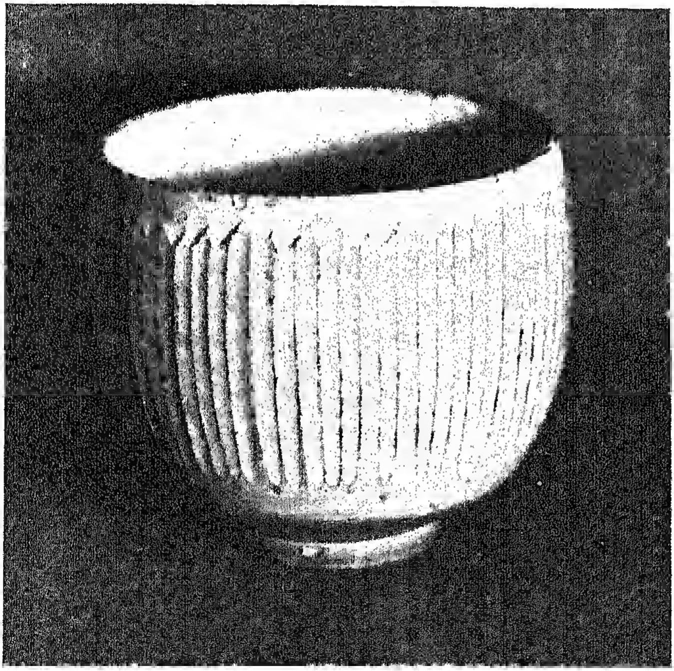
[1] '. . . pottery manufacturers know that mass production can in ceramics, at least as regards the quality of the body, help greatly towards improvements. The reason is that more efficient kilns can be used and better conditions of firing attained.'—Comp. Nikolaus Pevsner, *An Enquiry into Industrial Art in England*, 1937, p. 191 and p. 83.

men—but for various extrinsic reasons, chief of which is the failure of the manufacturer to interest himself in good design. The want of artistic initiative on the part of the manufacturers must be ascribed to the general lowering of taste under conditions of competitive industrialism. The public is ever increasingly out of touch with the making of articles of everyday use, and although its entrepreneurs, the buyers and salesmen of trade, are continually caught out in their under-estimation of what people like they cannot be entirely blamed for catering to safe markets. Even if, as Pevsner says, 'one cannot condemn an industrialist too severely because he does not jump at every suggested artistic improvement', and it 'would be absurd to suggest to the producer that he ought to ruin himself for the community', there is nevertheless no reason why he should not work as far as possible towards replacing bad forms and decorations with good, and realize, in spite of the cheerful assurances of buyers and travellers, that he must cater to bad taste, that one of the chief reasons why 'the public (apart from a few hopelessly insensitive individuals) likes' tawdry utensils, is because as a rule it can get no others. Apart from the initial expense of new moulds, and provided a competent designer is available, there is no apparent ground for believing that good commercial pottery should be any more expensive to make than bad.

It is obvious that the standards of the world's best pottery, for example, those of the T'ang and Sung periods in China and the best of the Ming, Korean celadons and Ri-cho, early Japanese tea-master's wares[1], early Persian, Syrian, Hispano-Moresque, German Bellarmines, some delft and English slipware, cannot well be applied to industrial work, for such pottery was a completely unified human expression. It had not

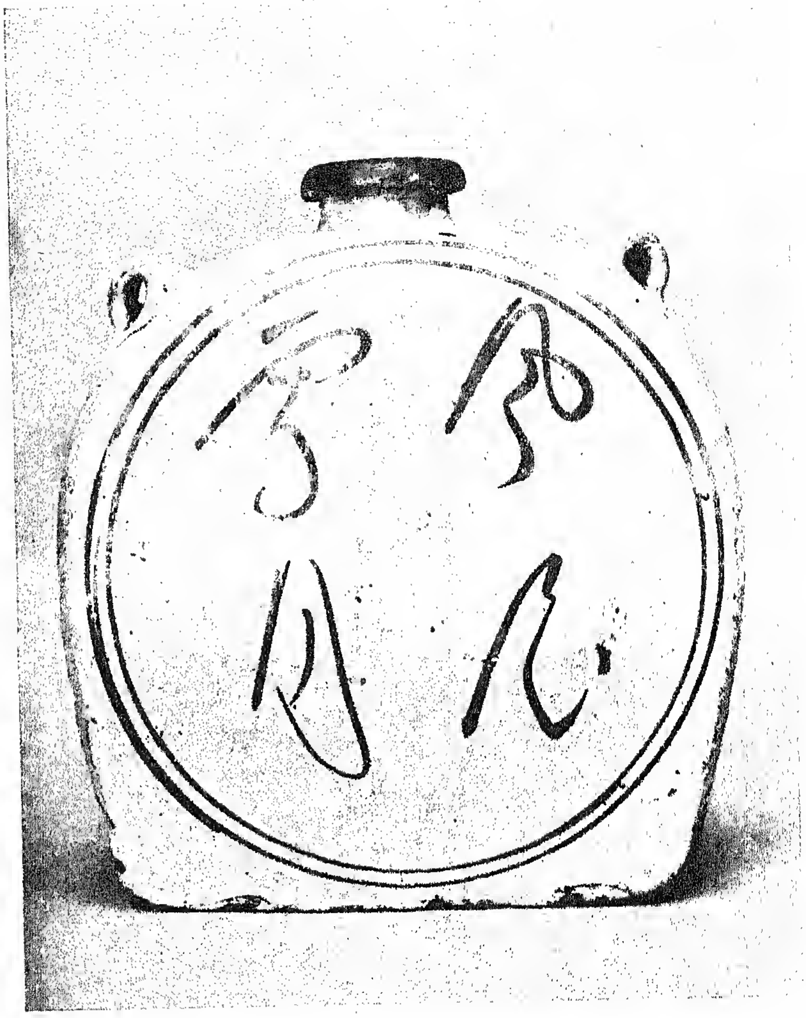
[1] i.e. pottery approved of by the Japanese tea-masters, adepts in the *Cha-no-yu*, or tea-ceremony, who have for several centuries been the foremost art critics in Japan and have counted among their numbers many creative artists of the first rank. For an account of the spirit of the *Cha-no-yu*, see *The Book of Tea* by Okakura Kakuzo, also A. L. Sadler, *Cha-no-yu*, London (1934).





1. Korean Porcelain Bowl, cut and combed. Korai dynasty, T'ing type. Early porcelain, freely handled.

2. Chinese Fluted Stoneware Bowl, Sung Dynasty (in the author's possession). This beautiful bowl was made of buff clay, wheel-thrown, cut, slipped and then fired in an oxidizing atmosphere. The cool lines and serrations show well assimilated influence from Graeco-Buddhist art and foil the full curves of the pot.



3. Stoneware Bottle, Sung Dynasty (Tz'ou-chou?). The four Chinese characters (snow, wind, moon, flower) symbolizing nature are exquisitely spaced on this unusual form. The strength of a square, suggested by the base angles and the shoulder lugs, encloses the circle.

been mechanized. Yet there is no doubt that much can be learned by the industrial potter or designer from the wares especially of the Sung and early Ming dynasties. The Chinese potters' use of natural colours and textures in clays, the quality of their glazes (e.g. the Ying-ching and T'zu-chow families), the beauty and vitality of their well-balanced and proportioned forms, could be a constant source of inspiration to the designer for mass-production no less than to the craftsman.

It is no discredit to the scientific and utilitarian advances of the English pottery industry to say that the beauty to which the Sung potters attained was far beyond the highest that from its beginnings in Josiah Wedgwood the English factories ever aimed at. The two traditions and methods of production are radically different, and the intuitive, organic qualities of Sung pottery can never be completely expressed by the rational and tectonic methods of big industry. Concentration upon mechanical production and utilitarian and functional qualities is to-day necessary and justified, and as already said there is no reason to suppose that factory-made utilitarian wares may not by reason of their precision, their pleasing lines and perfection of technique, added to complete adaptation to use, have a great beauty of their own. Even during the course of the last two centuries moulded English tea ware of admirable design has been made, and often its decoration, especially the 'Japan' and other conventionalized set patterns of the late eighteenth and early nineteenth centuries, has been, if not great art, at least possessed of much charm. It would be surprising if equally good patterns could not be turned out by able designers to-day.

It is quite otherwise with the studio potter. He is indeed constrained to look to the best of the earlier periods for inspiration and may, so far as stoneware and porcelain are concerned, accept the Sung standard without hesitation. As it is, there are a few English craftsman potters to-day who do accept it, and their work is incomparably the best that is now being turned

out.[1] Others go back to an outmoded 'arts and crafts' tradition, which seems to have had its origin in France in the last quarter of the nineteenth century and to have been largely influenced by modern Japanese designs, which became fashionable soon after the Paris Exhibition of 1867. Its characteristic features are weakness of form, especially of lip and foot, and, except in the case of the salt-glazed wares of the Martin Brothers (much of which was influenced by the same school of design), crudely coloured glazes in which all aesthetic quality is lost in technique, as always happens when the means are mistaken for the end. It is easy to understand the impression made on potters by the discovery, first in France by Chapelet and later in England by William Burton, of how to make the brilliant high-temperature single colour and flambé glazes of the Ching period in China; but in the absence of tradition, again technique triumphed over art and eccentricity and weakness over strength. The attempted revival of lustre painting under pre-Raphaelite influence by William de Morgan led as one might expect to nothing fresh and vital in form, or for that matter in decoration. Nor does the example of the Doulton company in reviving English salt-glazed pottery at the end of the last century seem to have had any influence on studio potters, who in the rare instances that they have made salt glaze have turned to the earlier Continental models.

In the absence of some agreement, however inarticulate, as to a common standard, one may hope to find an occasional work

[1] There has never been a European stoneware tradition except that of the Rhenish salt-glazed wares. 'Accepting the Sung standard' is a very different thing from imitating particular Sung pieces. It means the use so far as possible of natural materials in the endeavour to obtain the best quality of body and glaze; in throwing and in a striving towards unity, spontaneity, and simplicity of form, and in general the subordination of all attempts at technical cleverness to straightforward, un-selfconscious workmanship. A strict adherence to Chinese standards, howsoever fine, cannot be advocated, for no matter what the source and power of a stimulus, what we make of it is the only thing that counts. We are not the Chinese of a thousand years ago, and the underlying racial and social and economic conditions which produced the Sung traditions in art will never be repeated; but that is no reason why we should not draw all the inspiration we can from the Sung potters.

of genius in the free, or so-called fine arts (frequently then only the outcome of pain and poverty and lifelong obscurity); but in applied art, which depends upon collaboration in the workshop and constant sales to a public, there is even less hope. Indeed, amongst some at least of the free arts there does exist what one may call a classic standard, according to which the work of to-day, especially in literature and music, is compared with the great work of the past. That the criterion of beauty is a living thing and constantly in flux, is true, but here at least there is a continuous if ever changing consensus of opinion as to what may be called great achievement. In regard to pottery such a criterion can hardly be said ever to have entered the consciousness of Western man. In the East it has long been in existence, especially in Japan, where the aesthetic sensibility of educated people has been stimulated by the ablest of critics for some three hundred or more years. As space will only allow me to speak briefly of this great aesthetic cult and its unrivalled standard of artistic appreciation, I cannot do better than give a more or less condensed and paraphrased extract from an essay on popular, or folk, arts and crafts by Sōetsu Yanagi, the intellectual leader of the Japanese craft movement of to-day:

'I have many occasions to call at the residences of well-known art collectors, but I find too often that the articles of everyday use in their homes are far from being artistic, to say the least. They often leave me with a sad suspicion as to how much these collectors really appreciate beauty.

'To me the greatest thing is to live beauty in our daily life and to crowd every moment with things of beauty. It is then, and then only, that the art of the people as a whole is endowed with its richest significance. For its products are those made by a great many craftsmen for the mass of the people, and the moment this art declines the life of the nation is removed far away from beauty. So long as beauty abides in only a few articles created by a few geniuses, the Kingdom of Beauty is nowhere near realization.

'Fortunately, in Japan, handicraft objects have been treasured through the channel of ceremonial tea. *Cha-no-yu* in the last analysis is a means of harmonizing life and beauty. . . . It may be thought of as an aesthetics of the practical arts. In all its appurtenances, whether it be in the architecture, the garden, or the utensils, the first principle is utility and the adornment of life with refinement. Not beauty for beauty's own sake, but beauty answering all immediate needs of life—that is the essence of ceremonial tea. . . .

'One may ask, what then is the nature of the beauty which has been discovered by these tea-masters? . . . In the first place it is non-individualistic. . . . As in medieval Europe art meant adherence to tradition, so in the East all works of arts or crafts were governed equally by common principles. . . . Some of the most famous tea-bowls were originally the simplest of utensils in popular use in Korea or China; many of them were the rice bowls of Korean peasants. But the amazingly keen eye of the *Cha-no-yu* master has discovered in these odd, neglected pieces a unique beauty; for what most appeals to him are the things originally made for everyday use. In brief, *Cha-no-yu* may be defined as an aesthetics of actual living, in which utility is the first principle of beauty. And that is why such great significance has been given to certain articles necessary for everyday life. . . .

'The next important aspect of the works of people's art is that they are simple and unassuming. Here the quality of extravagance that is always associated with expensive art objects is wholly absent, and any surplus of decorativeness is objectionable. . . . Simplicity may be thought of as characteristic of cheap things, but it must be remembered that it is a quality that harmonizes well with beauty. That which is truly beautiful is often simple and restrained. . . . I am told that St. Francis of Assisi advocated what he called 'Holy Poverty'. A thing possessed in some manner of the virtue of poverty has an indescribable beauty. Indeed, Beauty and Humility border upon each other. What is so appealing in the art of the people is this very quality,

. . . beauty accompanied by the nobleness of poverty. The Japanese people have a special word *shibui* to express this ideal beauty. . . . It is impossible to translate it satisfactorily into one English term, "austere", "subdued", "restrained", these words come nearest. Etymologically, *shibui* means "astringent", and is used to describe profound, unassuming and quiet feeling. The mere fact that we have such an adjective would not call for second thought, but what does call for special note is the fact that this adjective is the final criterion for the highest form of beauty. It is, moreover, an ordinary word, and is repeated continually in our casual conversation. It is in itself unusual that a whole nation should share a standard word for aesthetic appraisal. Here in this criterion of ours for the best and most beautiful may be observed the fundamental principle of the aesthetic tastes of the Japanese people. . . . If you have travelled much in rural Japan you must have come across one of these stone monuments, with the inscription *Sangai Banrei Tō*, at a crossroad or in a deserted corner. The inscription means "a monument to the unknown, departed souls of the million people of the world". This monument is an expression of the Buddhist's compassion for the countless number of forgotten and uncared-for souls. I am one of those whose prayer it is to erect such monuments in the Kingdom of Beauty.'

Thus from a Buddhist background, ethically much akin to the medieval Christianity on which the neo-Thomists have based their attitude towards art, Mr. Yanagi seems to me in these arresting and moving sentences to have thrown down a challenge not only to his Japanese contemporaries but to us as well—a challenge to our over-accentuated individualism. For one may indeed look back with an acute sense of loss to those periods when the communal element, with its native religious, psychological and aesthetic basis, was all-powerful as an ennobling and transmuting influence and source of life.

A potter's traditions are part of a nation's cultural inheritance and in our time we are faced with the breakdown of the

Christian inspiration in art. We live in dire need of a unifying culture out of which fresh traditions can grow. The potter's problem is at root the universal problem and it is difficult to see how any solution aiming at less than the full interplay of East and West can provide either humanity, or the individual potter, with a sound foundation for a world-wide culture. Liberal democracy, which served as a basis for the development of industrialism, provides us to-day with a vague humanism as insufficient to inspire art as either the economics of Karl Marx or the totalitarian conception of national life, but at least it continues to supply an environment in which the individual is left comparatively free.

Our need of a criterion in pottery is apparent and seems to be provided by the work of the T'ang and Sung potters which during the last twenty years has been widely accepted as the noblest achievement in ceramics. But the successful assimilation of strange stimuli requires a healthy organism, and it remains to be seen whether there is enough vitality in Europe to absorb from early Chinese pottery even more than we did during the eighteenth and nineteenth centuries from late Chinese porcelain. At the moment it is difficult to believe that the general arrogance of our materialism and the particular self-sufficiency of the pottery trade will permit the subtler scale of early oriental values to be perceived, except by artists and some sensitive people of leisure. Influences from alien cultures either upon art or industry must pass through an organic assimilation before they can become part and parcel of our growth. This happens, moreover, only when they supply an inherent need, and is usually inaugurated by the enthusiasm and profound conviction of men who have themselves succeeded in making the synthesis. The superficial imitation of early Chinese shapes, patterns, colours and technique signify nothing unless new life emerges from the fresh combination. The temptation for the individual potter is to stand back with the paralysis of frustration in face of such a sea of change, but we cannot afford to wait until the tide of a new culture rises.

The necessity for a psychological and aesthetic common foundation in any workshop group of craftsmen cannot be exaggerated, if the resulting crafts are to have any vitality. That vitality is the expression of the spirit and culture of the workers. In factories the principle objectives are bound to be sales and dividends and aesthetic considerations must remain secondary. The class of goods may be high, and the management considerate and even humanitarian, but neither the creative side of the lives of the workers nor the character of their products as human expressions of perfection can be given the same degree of freedom which we rightly expect in hand work. The essential activity in a factory is the mass-production of the sheer necessities of life and the function of the hand worker on the other hand is more generally human.

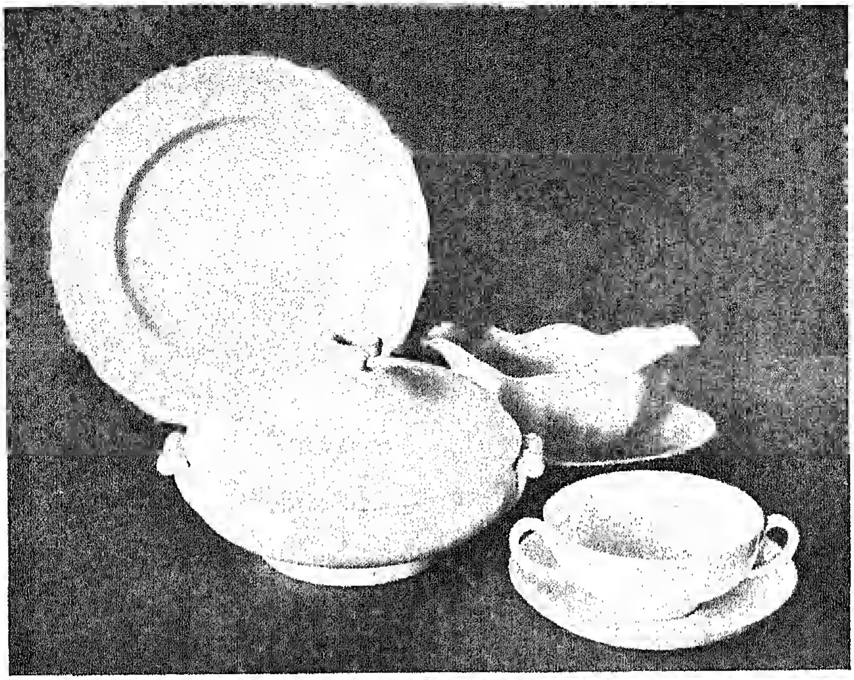
The problem is made increasingly difficult for the reason that the people who are attracted to-day by the hand crafts are no longer the simple-minded peasantry, who from generation to generation worked on in the protective unconsciousness of tradition, but mainly self-conscious art students. They come to me year after year from the Royal College, or the Central School, or Camberwell, for longer or shorter, usually shorter, periods of apprenticeship. As soon as they have picked up enough knowledge, or what they think is enough, off they go to start potting on a studio scale for themselves. Very few have proved themselves to be artists. And what of the others, those thousands who pass through these schools and then either disappear from sight or continue to produce bad work. Again, in the past tradition would have developed and used their more moderate talents; in our own one cannot escape the sense of a great wastage.

In crafts the age-old traditions of hand work, which enabled humble English artisans to take their part in such truly human activities as the making of medieval tiles and pitchers and culminated in magnificent co-operations like Chartres Cathedral, have long since crumbled away. The small estab-

lishments of the Tofts and other slipware potters were succeeded by the factories of the Wedgwoods and the Spodes, and in a short space of time the standard of craftsmanship, which had been built up by the labour of centuries, the intimate feeling for material and form, and the common, homely, almost family workshop life had given way to specialization and the inevitable development of mass production. For that no individual can be praised or blamed: like many another institution it arose in response to a human need, moving parallel on the one hand with the slow progress of economic democracy, and on the other with an unprecedented rise in the population. But although we have now reached a point where for the first time in history we are able to produce enough and more than enough for all, the trouble from the artist's or craftsman's, or for that matter any sane person's point of view, is not only that the problem of equitable distribution is still unsolved, but that so many of the things we have thus contrived to make are inhuman.

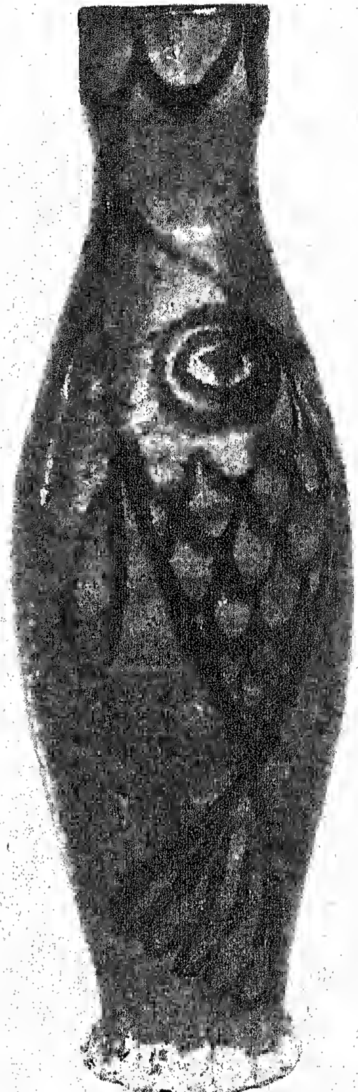
In the field of ceramics the responsibility for the all-pervading bad taste of the last century and the very probable ninety per cent. bad taste of to-day lies mainly with machine production and the accompanying indifference to aesthetic considerations of individual industrialists and their influence on the sensibility of the public.[1] Yet although industrialists will as time goes on become more and more conscious of the desirability of, if not the necessity for good form and decoration, it is also plain that during the last twenty-five years a far reaching change in aesthetic judgment has come about, not only in England, but literally all over the civilized world. A new type of craftsman, called individual, studio, or creative, has emerged, and a new idea of pottery is being worked out by him as a result of an

[1] This is not to say that any better taste was shown in the work of the late nineteenth and early twentieth-century hand-potters in England up to fifteen or twenty years ago, or by many of them even now; but it is probable that the example set by industrialism and the strain of getting away from it was largely responsible even for their demoralization.



4. Contemporary English Industrial Pottery. Johnson Bros. and Wedgwood & Sons.

5. English Early Industrial Soft-paste Porcelain. Chelsea-Derby. Rococo elegance and Georgian dignity still predominate but in form and sensitiveness to material such examples cannot be compared with the pots of Plate I (see page 41).



6. Tall Stoneware Vase, by W. Staite Murray. Individual English potter (in the possession of Dr. Osmund Frank).

immensely broadened outlook. Another wave of inspiration has come to us from the Far East, and out of the tomb-mounds of long dead Koreans and Chinese, looted and disturbed by the encroachment of Western commercialism, has arisen a new appreciation of ceramic beauty.

It is just about fifty years ago that Carrière, a young French sculptor, began to make stoneware based upon old Japanese models. He has been followed by a number of potters in Paris, such as Delaherche, Decoeur, Cazin and many others, whose work has been inspired by the simplicity and restraint of the Sung potters. In Holland, Germany, Austria, Scandinavia, America, Japan and England there has been a similar response to the same stimulus, and factory products are being more and more influenced by them. One need only mention Sèvres and Copenhagen. Amongst all these individual efforts to my mind the Japanese and English are the best.

Pots, like all other forms of art, are human expressions: pleasure, pain or indifference before them depends upon their natures, and their natures are inevitably projections of the minds of their creators. It is unfortunate that as a consequence of its divorce from life, the 'applied' no less than the 'fine' art of our time, more than in any other age, suffers from excessive self-consciousness, or what is often called pose, a very different thing from the unconscious, inherent, personal and race character which has distinguished all the great periods of creative art. It is also important to remember that, although pottery is made to be used, this fact in no wise simplifies the problem of artistic expression; there can be no fulness or complete realization of utility without beauty, refinement and charm, for the simple reason that their absence must in the long run be intolerable to both maker and consumer. We desire not only food but also the enjoyment and zest of eating. The continued production of utilities without delight in making and using is bound to produce only boredom and to end in sterility. And the greater part of what passes for pleasure in the form and decoration and

colour of pottery for the people to-day is so banal, so false and ridiculous in the confusion of mechanical perfection with beauty, as to be in itself alone an indictment of our popular half-culture.

The art forms of a community are the crystallizations of its culture (which may indeed be a very different thing from its civilization), and pottery traditions are no exception to the rule. In the T'ang period it is not difficult to recognize the Chinese genius for synthesis, here reinterpreting Greek and Buddhist ideology in terms of contemporary need, and combining these elements within the native framework of Taoist and Confucian concepts, thus fundamentally modifying and extending the boundaries of their ideas of beauty and truth. In the greatest period, that of the Sung dynasty, all these different influences are welded together in one, for unification was then supreme. Until the beginning of the industrial era analogous processes of synthesis had always been at work amongst ourselves, but since that time the cultural background has lost much of its assimilating force, and the ideas we have adopted and used have been moulded into conformity with a conception of life in which imagination has been subordinated to invention and beauty to the requirements of trade. In our time technique, the means to an end, has become an end in itself, and has thus justified Chinese criticism of us as a civilization 'outside in'.

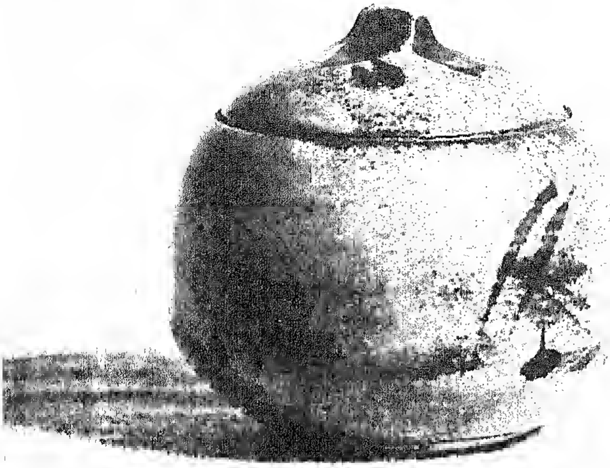
Since the last quarter of the nineteenth century, the reaction started by William Morris has been taking place mainly outside industry and has culminated in what I have called the individual, or artist, craftsman. Beginning in protest against the irresponsible use of power, it came to an end in pseudo-medieval crafts little related to national work and life. Thence has arisen the affirmation of the mechanical age in art—functionalism. This, through let us say, Picasso,[1] Corbusier and Gropius of

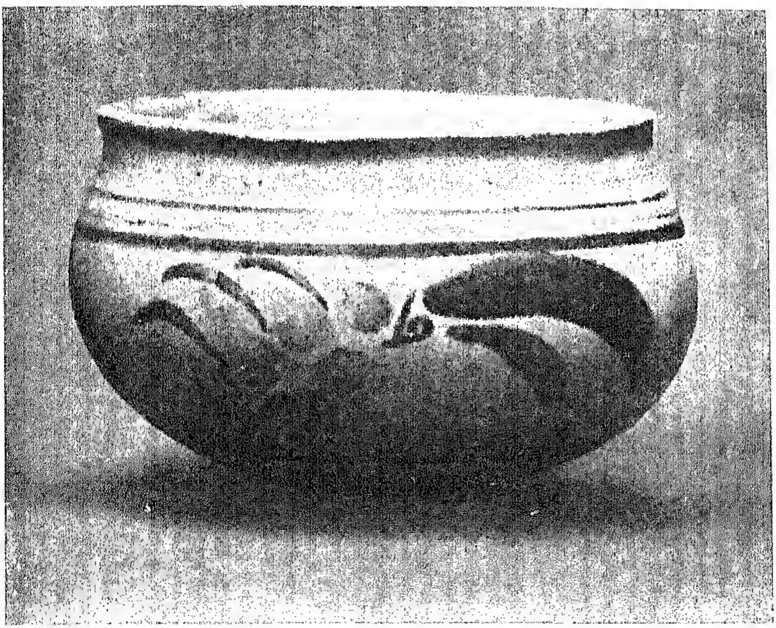
[1] It is worth recording that Picasso himself, perhaps the most creative artist alive, has written, 'decorative art bears no resemblance to easel painting, to the production of a picture. One is utilitarian, the other a noble play. An armchair means the back against which one leans. It is a utensil. It is not art.' *Creative Art*, June 1930.

the Bauhaus, is having its effect on all crafts. A movement which however based by its initiators on a new and dynamic concept of three-dimensional form, tends amongst those who attempt to carry the idea into industry to an over-intellectual effort to discover norms of orderliness and utility. Such a process limits the enjoyment of work to the designer, and overlooks the irregular and irrational element in all fine activity including the making of pottery. Herein lies the significance of the artist-craftsman as distinct from the factory designer. Almost alone amongst workmen does he exercise the responsibility of making things for full human use—objects which are projections of men—alive in themselves. To him the question of standard is of vital importance, and through his work to industry, and through industry to everyone. He is faced with a broken tradition, and, what is even more serious, with a culture in rapid process of change. Our sensibility to beauty is ministered to for the most part only by the work of a handful of men of genius, for the history of all nations with a developing industrialism shows that the unconscious, intuitive craftsman breaks down under the strain of transition from hand and tool to industrial machinery. His native ability and good taste, his insight and his capacity to judge of and assimilate new ideas become perverted. Only the artist and craftsman of unusual perception and strength of character stands a chance of selecting what is best from the welter of ideas which rolls in upon him to-day. As soon as the craftsman becomes individual and detached from his tradition he stands on the same footing as the artist. This may not signify much when one thinks of the number of artists in relation to the number of paintings done each year which will appeal with any conviction to men a century hence! But the important question is how in our disintegrating times individual potters are to discover their particular kind of truth, in other words, their highest standard, and further, by what means it can be passed on to other artist-potters to the end that humanistic work of true merit, especially for domestic use, may be produced.

I can still remember vividly how twenty-five years ago I stood before the magnificent examples of the pottery of the Sung dynasty in the Tokyo Museum wondering how an individual potter of to-day could possibly appropriate to himself a beauty so impersonal, so inevitable—the patient unassuming outcome of centuries of tradition gradually developing through the experience of material and increasing complexity of need, and the sublimated emotion of a long succession of Chinese or Korean workers. I was abashed. I know now that it is a task beyond the power of any one man, and what makes the matter still worse, far from there being any unity of purpose and faith, at the present moment there is such an obsession with the individual point of view among English craftsmen, that one often hears them ridicule the very idea of a new communal standard. Independence once achieved is very precious, but an exaggerated pride in its possession stands bluntly in the way of concurrence in either aim or action, and the pride is only too often merely that of an artist on a dunghill. Since the Great War, however, there have been at least some signs of change, in science, in philosophy, in politics, even in the world-wide acceptance by the younger artists of a more or less common geometric abstract. But even this new common factor has been accompanied by a growing awareness of emptiness and sterility.

We craftsmen, who have been called artist, have the whole world to draw upon for incentive beauty. It is difficult enough to keep one's head in this maelstrom, to live truly and work sanely without that sustaining and steadying power of tradition, which guided all applied art in the past. In my own particular case the problem has been conditioned by my having been born in China and educated in England. I have had for this reason the two extremes of culture to draw upon, and it was this which caused me to return to Japan, where the synthesis of East and West has gone farthest. Living there among the younger men, I have with them learned to press forward in the hope of binding together those elements from the ends of the

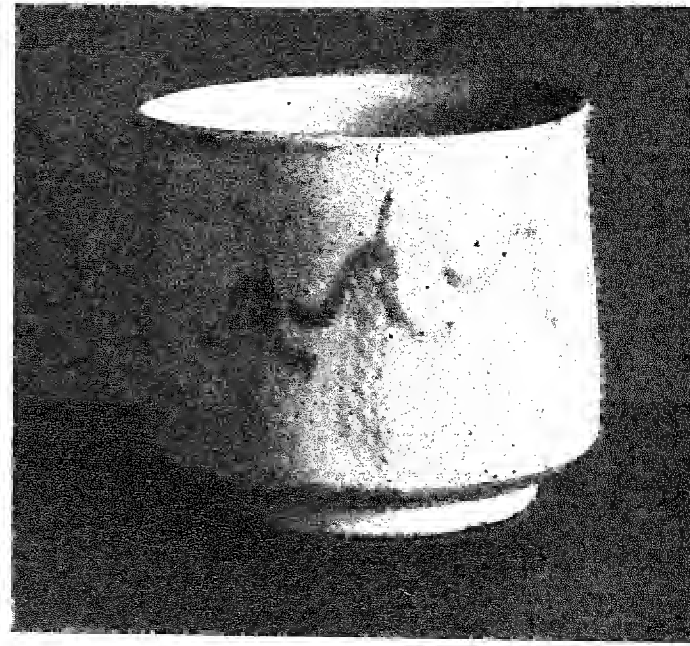




7. Small covered Stoneware Pot, brown and rust on grey, by Norah Braden.

8. Stoneware Bowl, brown and olive on grey, by Norah Braden. Individual English potter.

9. Stoneware Bottle, grey flecked with bronze; box ash glaze. Katherine Pleydell Bouverie, individual English potter.



10. Early Japanese Seto Stoneware Bowl attributed to the Korean Genpin, 16th century; good brushwork pattern.

earth which are now giving form to the art of the coming age. I may tend to overstress the significance of East and West to one another, yet if we consider how much we owe to the East in the field of ceramics alone, and how recent a thing is Western recognition of the supreme beauty of the work of the early Chinese, perhaps I may be forgiven for the sake of the first-hand knowledge which I have been able to gather both of the spirit and manner in which that work was produced.

The manner, or technique, will be dealt with in the following chapters: here at the outset I am endeavouring to lay hold of a spirit and a standard which applies to both East and West. What we want to know is how to recognize the good or bad qualities in any given pot, and we are at least able to say that one should look first for the nature of the pot and know it for an expression of the potter in the background. He may be an unknown peasant or he may be a Staite Murray. In the former case his period and its culture and his national characteristics will play a more important rôle than his personality; in the latter, the chances are that personality will predominate. In either case sincerity is what matters, and according to the degree in which the vital force of the potter and that of his culture behind him flow through the processes of making, the resulting pot will have life in it or not.

I have often sought for some method of suggesting to people who have not had the experience of making pottery a means of approach to the recognition of what is good, based upon common human experience rather than upon aesthetic hairsplitting. A distinguished Japanese potter, Mr. Kawai of Kyoto, when asked how people are to recognize good work, answered simply, 'With their bodies'; by which he meant, with the mind acting directly through the senses, taking in form, texture, pattern and colour, and referring the sharp immediate impressions to personal experience of use and beauty combined. But as pottery is made for uses with which we are all familiar, the difficulty probably lies less in one's ability to recognize proper adaptation

of form to function than in other directions, primarily perhaps in unfamiliarity with the nature of the raw material, clay, and its natural possibilities and limitations, and also in uncertainty as to the more imponderable qualities of vitality and relative excellence of form, both of which are indispensable constituents of beauty. It must always be remembered that the dissociation of use and beauty is a purely arbitrary thing. It is true that pots exist which are useful and not beautiful, and others that are beautiful and impractical; but neither of these extremes can be considered normal: the normal is a balanced combination of the two. Thus in looking for the best approach to pottery it seems reasonable to expect that beauty will emerge from a fusion of the individual character and culture of the potter with the nature of his materials—clay, pigment, glaze—and his management of the fire, and that consequently we may hope to find in good pots those innate qualities which we most admire in people. It is for this reason that I consider the mood, or nature, of a pot to be of first importance. It represents our instinctive total reactions to either man or pot, and although there is no guarantee that our judgment is true for others, it is at least essentially honest and as likely to be true as any judgment we are capable of making at that particular phase of our development. It is far better to run the risk of making an occasional blunder than to attempt cold-blooded analyses based upon other people's theories. Judgment in art cannot be other than intuitive and founded upon sense experience, on what Kawai calls 'the body'. No process of reasoning can be a substitute for or widen the range of our intuitive knowledge.

This does not mean that we cannot use our common sense in examining the qualities in a pot which give us its character, such as form, texture, decoration and glaze, for analytic reasoning is important enough as a support to intuition. Beginning with the colour and texture of the clay, one must ask, apart from its technical suitability, whether it is well related to the thrown or moulded shape created by the potter and to the pur-

pose for which the pot is intended—what, for example, is appropriate for a porous unglazed water jug is utterly unsuitable for an acid jar. Does its fired character give pleasure to the eye as well as to the touch; its texture contrast pleasingly with the glaze? Has it where exposed to the flame turned to a dull brick red which contrasts happily with the heavy jade green of a celadon? Does it show an interesting granular surface under an otherwise lifeless porcelain glaze? Has its plasticity been such as to encourage the thrower to his best efforts, for the form cannot be dissociated from its material. The shape of a pot cannot be dissociated from the way it has been made, one may throw fifty pots in an hour, on the same model, which only vary in fractions of an inch, and yet only half a dozen of them may possess that right relationship of parts which gives vitality—life flowing for a few moments perfectly through the hands of the potter.

Apart from the basic clay, the form of the pot is of the first importance, and the first thing we must look for is, as already indicated, proper adaptation to use and suitability to material. Without these we cannot expect to find beauty in any of its modes, nobility, austerity, strength, breadth, subtlety, warmth—qualities which apply equally to our judgments of human and ceramic values. Nor do these qualities arise from human characteristics alone, but from a common recognition of forms, whether man-made or natural, which we associate with them. Of all forms we know best our own and attach to it the greatest degree of evocative emotion; next come animal, plant and mineral forms; lastly, and mainly in our own time, geometric abstracts, largely the inventions of man's brain. It is not without reason that important parts of pots should be known as foot, belly, shoulder, neck and lip, or that curve and angle should often be thought of as male or female. Beauty of ceramic form, which is at once subjective and objective, is obtained in much the same manner as in abstract (rather than representational) sculpture. It is subjective in that the innate

character of the potter, his stock and his tradition live afresh in his work; objective in so far as his selection is drawn from the background of universal human experience.

Subordinate to form but intimately connected with it is the problem of decoration, and the question arises whether the increased orchestration adds to the total effect or not. Decoration will be treated more fully later on, here it is enough to say that, although some of the very finest pots are quite plain, it is nevertheless of the greatest significance. Many a good piece has been spoiled by a weak or tasteless design, printed or applied in one way or another: not only must the pattern be good in itself and freely executed, but it must combine with and improve the form and harmonize with the natural variations of both colour and texture of body and glaze.

The upshot of the argument is that a pot in order to be good should be a genuine expression of life. It implies sincerity on the part of the potter and truth in the conception and execution of the work. By this reasoning we are thrown back upon the oldest of questions, but there is no escaping fundamental issues in discussing problems of art at a period of break-up and change. Art is an epitome of life experience and in searching for a standard in pottery elastic enough to cover both past and present we are compelled to look far afield and to examine the principles upon which the best pots of East and West have been based. In a broad way the difference between the old potters and the new is between unconsciousness within a single culture and individual consciousness of all cultures. And to this one can only add that until a life synthesis is reached by humanity the individual potter can only hope to deepen and widen his consciousness in anticipation and contribution towards that end.

The method by which a pot is formed determines its general character, whether hand modelled or built up out of coils or slices, or freely thrown on the wheel, or thrown in a mould, or cast entirely in a mould—each process conditions the interpretation of the original idea, and each has a limited range of right

11. English Mediaeval Pitcher, 14th century. Wheel thrown, combed, and with a pinched foot. The lead ore (galena) glaze has probably been dusted over a coating of damp slip. The severe dignity of form allies such monastic pitchers with Gothic architecture. Inset, part of an English mediaeval tile (see pages 11 and 32).

12. Primitive Persian Jar, circa 3000 B.C., wheel-thrown, pigmented but unglazed. The manner in which the painted pattern picks up and vitalises the subtle variations of the large form should be noted.

usage, from the easy flowing application of which follows the sense of satisfaction and adequacy of technique. It is for this reason that the industrial practice of rigidly separating designer on paper from maker in clay is responsible for much of the deadness of commercial pottery, for it is a waste of opportunity as well as a straining of technique to make moulded pots as like thrown pots as possible. The beauty of each method lies in using that method honestly, for what it is worth, not in imitating other quite different processes.[1]

The range of plastic beauty achieved in primitive pottery, made chiefly by the hands of women without a wheel and with tools only of wood or stone, basketry, textiles, leaves of trees or stitched animal hides, is immense. The whole world seems to have contributed to it during thousands of prehistoric years: Minoan, archaic Greek, African, North and South American, pots of the Black Earth Region and neolithic China, pigmented but unglazed, often so fine that one might be tempted to surrender all claim for the supremacy of eleventh and twelfth century China, were it not for the fact that the general cultural and technical achievements of the Sung Chinese were so much greater. For this reason I shall deal in this book for the most part with wheel-thrown forms, which reached their greatest perfection round about that period.

A pot thrown on a good wheel with responsive clay, but not too soapy in texture, is impressed and expressed, urged and

[1] Every designer either on paper or of model parts should have first-hand experience not only of the processes of manufacture, but also of the limitations no less than the potentialities of his materials. What is obviously needed is a new type of designer who knows both approaches to pottery and can therefore keep industry in touch with fresh artistic expression in the studio. Without such an alliance in the near future between artist-craftsman and factory, it is difficult to conceive how pots could be made in Staffordshire which would be even respectable in the scale of beauty the world has known. The tendency to employ sculptors and painters of reputation to make designs for the industry is useful up to a point, but it gives no guarantee that these artists know and feel their medium, nor that the factories and their reduplicating processes will do justice to the designs. The link is not close enough.

pulled and coaxed through a series of rhythmic movements, which like those of a dance are all related and interdependent. The spinning wet clay must be kept dead true to the centre of the wheel while it is being hollowed and drawn up, expanded and contracted into a living embodiment of the potter's intention. The preconceived shape will include the mark of each part of the process of throwing, the ribs left by the fingers, the upward thrust of the cylinder from the wheel-head to the major curve of the belly, the fulness or leanness of that curve, the pause and turn on the shoulder, often accentuated with ridge or collar, where convex movement changes to concave, the neck tapering to the lip with a concluding accent and conciseness of finish. Many of the noblest and most spontaneous pots are complete at this point, but others, especially such as are to have a foot-ring or bevelled lip, need to be pared on the wheel when half dry. This cutting off of shavings gives a different and sharper quality of finish: the difference between modelling and carving; and the two surfaces must be brought into harmony with one another.

The foot, upon which the pot stands, should be reasonably wide for stability, but over and beyond that its angles and proportion should relate to the lip, to which the eye instinctively leaps. The cutting of the foot does not end with the profile; the inside of the ring is nearly always hollowed out in the East. Stoneware pots are seldom glazed over the bottom, and the exposed clay tells how thoroughly the potter felt the contrast between the profile with its necessary concluding foot and the perfect curve of the pot through it.

There are many types of foot-cutting well understood by Oriental potters and often associated with certain kinds of vessel or with certain localities, in which refinement has been worked out by a long process of trial and error into a fixed tradition.[1]

It is interesting to see an Oriental pick up a pot for examina-

[1] See p. 86 for illustrations of examples.

tion, and presently carefully turn it over to look at the clay and the form and cutting of the foot. He inspects it as carefully as a banker a doubtful signature—in fact, he is looking for the bona fides of the author. There in the most naked but hidden part of the work he expects to come into closest touch with the character and perception of its maker. He looks to see how far and how well the pot has been dipped, in what relation the texture and colour of the clay stand to the glaze, whether the foot has the right width, depth, angle, undercut, bevels and general feeling to carry and complete the form above it. Nothing can be concealed there, and much of his final pleasure lies in the satisfaction of knowing that this last examination and scrutiny has been passed with honour.

As for the shapes of pots and good proportions in different types, it is impossible to do more than offer a few general suggestions in the footnotes to the illustrations of particular examples. Artists of many races have believed that there are fundamental laws of proportion and composition, and I too believe it; for what we call laws are no more than generalizations founded on our sense experience, but when the attempt is made to reduce such generalizations to mathematical formulae, it is difficult to believe that they can be applied in practice without robbing the craftsman's work of its vitality. No formula, however accurate, can take the place of direct perception.

Here, for example, are a few of the constructional ideas that I have found useful:

1. The ends of lines are important; the middles take care of themselves.

2. Lines are forces, and the points at which they change or cross are significant and call for emphasis.

3. Vertical lines are of growth, horizontal lines are of rest, diagonal lines are of change.

4. Straight line and curve, square and circle, cube and sphere are the potter's polarities, which he works into a rhythm of form under one clear concept.

5. Curves for beauty, angles for strength.

6. A small foot for grace, a broad one for stability.

7. Enduring forms are full of quiet assurance. Overstatement is worse than understatement.

8. Technique is a means to an end. It is no end in itself. If the end is achieved, and a fine pot comes out of the kiln, let us not be hypercritical about fortuitous blemishes. Some of the most beautiful pots in the world are full of technical imperfections. On the other hand, the Japanese have often gone too far and made pots with deliberate imperfections and overstatements of technical characteristics. This is nothing more than a kind of intellectual snobbery, rather to be expected from groups of second-rate tea-masters, and a very different thing from the sanded foot of Ming porcelains or the Korean foot-ring, spur-marked with quartz, whose virtue was the virtue of necessity. There was no question of pose about it. But there comes a time when the accidentals of potting have to be considered consciously as such, and that is the position to-day.

Round the question of accidentals and incidentals in pottery making revolve some of the chief difficulties we encounter in reaching a new idea of standard. After the symmetries and microscopic precision of mass production these two words seem such mouthfuls to swallow. But if T'ang or Sung pottery is accepted as the highest achievement in ceramics they will have to be swallowed. Eastern and Western thought alike regard man and his work as very inadequate and variable affairs, and an Oriental art lover eyes any very perfect piece of technique with the suspicion that it contains little depth of meaning. In all the greatest pottery of the world the natural limitations of both the material and the maker are accepted without question. In China the clays are often coarse and usually exposed, the glazes are thick, and crackled, and run, and occasionally skip, the brushwork is vigorous and calligraphic, not realistic and 'finished', the throwing and moulding are frank, and accidental kiln effects are frequent.

Apologies for these 'imperfections' by authorities like the late Mr. Joseph Burton on the ground that they were incidental to primitive handwork amuse Oriental writers on art, who feel that such expressions of opinion merely expose the critic's lack of insight. The Far Eastern point of view is that all these qualities can be used and that they are incidental to nature rather than accidental.

A more recent dictum occasionally heard is to the effect that where irregularities occur the potter 'has not realized his intentions'. It should not be forgotten, however, that within the potter's intentions are included all sorts of variations depending on the nature and manner of use of his materials and ranging from the fortuitous and often highly effective skipping of a glaze to wide differences in its colour and quality, and that so long as they do not involve structural weaknesses or by their eccentricity detract from the beauty of the pot, they are acceptable to him. It is the uniformity of perfection that kills. On the other hand, if a pot is spoiled by blistering or cracking, it is spoiled, and there is no doubt about it.

During the long Victorian period 'perfect finish' came to mean two things, either great realistic detail and meticulous surface finish or a concealing of the means by which the end had been achieved. Even so great a rebel as Whistler proclaimed the latter idea in print if not in paint. An unprejudiced survey of pre-industrial pottery, especially Far Eastern, must lead to the conclusion either that its makers were first class bunglers or that we have got our values upside down. But at the same time, if feeling in this matter is indeed changing, in spite of the emphasis on technical precision necessitated by mechanically made products, nevertheless, the way in which craftsmen rightly make use of 'accidentals' and 'incidentals' has inevitably been lost sight of. Technique has become so complex and so hidden away from common sight that we no longer know good clay, good throwing, turning or brushwork, or good firing when we see them. Nor are we constantly reminded through doing things

by hand, how from each part of a craftsman's job of any real interest variations emerge, which must be dealt with on the spur of the moment. The closest analogy is that of the kitchen, with which a pottery has so much in common. Many of the problems touched on in this chapter will appear more familiar if translated into terms of good home cooking, for despite individual preferences we all know something from experience about good and bad food. But to-day the average man or woman judges pots by a Victorian trade standard and food apparently by none at all. And although a few people turn to books, museums and collectors for enlightenment, there are no good books save technical[1], and the acquisitive impulse of the collector is responsible for many false values. Rarity is no guarantee of beauty, and the cunning search for it is only a hindrance to appreciation of beauty as normality.

The extent to which quite ordinary people react to the changing beauty of a shape on the potter's wheel has been a continual revelation to me of their latent desire, and often capacity, to make good things, to use them or at the very least to learn to know them. To make a thing oneself is the nearest way to understanding; but although our newer education is insistent upon this counterpoise to theoretic learning, there are hardly any schools or teachers in this country who are introducing boys and girls to the kind of making which involves real beauty. The sort of thing that goes by the name of Art and Craft in most schools, including many art schools, the next generation could very well do without.

So far as pottery is concerned, school training is a doubtful method in any case. It does not bring students into contact with the actual conditions of the craft either as hand or machine work. At best they receive no more than a half training as individual potters. The number who have come to me from

[1] Exceptions must be made in the case of Dora Billington's short but informative volume, *The Art of the Potter*, Oxford University Press, 1937, and as a handbook for the student, Geo. T. Cox's *Pottery for Artists, Craftsmen and Teachers*, Macmillan.

well-known schools without even an elementary knowledge of clays, of throwing, of glazes and their composition, of kilns and their construction and use—the very foundations of the craft—reveals a state of affairs which could not be tolerated in any other subject.

In childhood a natural process of rehearsal and growth through experience is constant, but educationalists do not take this sufficiently into account in the teaching of pottery. I often see electric kilns and power wheels installed in schools, and clay, pigments and glazes bought ready made. This is beginning at the end, and is a loss of opportunity and a waste of money. Children and students learn far more by re-experiencing, as far as possible, the evolution of the potter's craft from its primitive origins. They enjoy finding and digging their own clay, building their own kilns and making their own colours and glazes as potters used to do before the machine age. Shoji Hamada recounted to me once how when he was a boy in a Japanese village he took part as a matter of course in making half the things used by the villagers with the consequence that he grew up knowing out of his body the nature of wood, of cotton and silk, of metal and clay and foodstuffs. Local tradition was still pure enough to provide a standard of form, pattern and colour which embodied that deeper wisdom of beauty in articles of daily use which we have almost lost. Such a child could never be entirely deadened by mechanical and monetary values. Only with the enthusiasm engendered by such personal experience is there any likelihood of a generation growing up capable of appreciating and demanding beauty in our domestic pottery. Until that time comes the individual potter, together with other artist craftsmen, is bound to remain outside the normal flow of a healthy national life.

Chapter II

RAKU—ENGLISH SLIPWARE—STONEWARE—PORCELAIN

The four principle wares with which I propose to deal in this book cover broadly the evolution of glazed pottery.

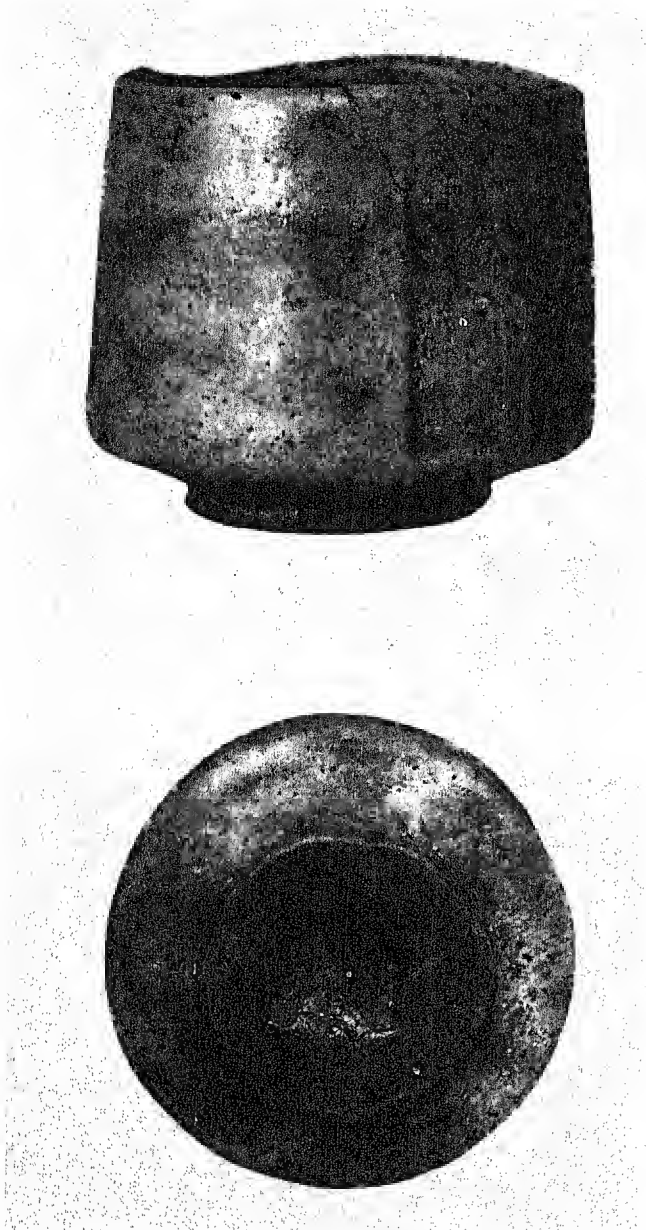
Japanese raku glaze and overglaze enamels, owing their distant origins to Persia and Egypt, melt at about the red heat of a bonfire (750° C.).

English slipware, which belongs to a simple lead-glazed family of earthenware found all over Europe and Asia, and probably originating in Egypt, is fired at an intermediate orange heat round about 1000° C.

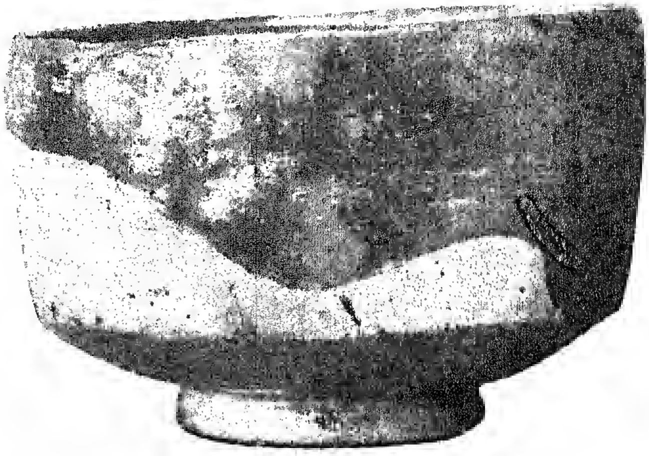
Oriental stoneware and porcelain, originating in China between the second and sixth centuries, are fired at white heat (1250°–1350° C.). Between these extremes of temperature practically all pots are made.

RAKU

The low temperature at which Raku is fired brings the making of pots within the range of any enthusiast. One may start with very little apparatus and expense; a broad range of colours is available, and such a direct control of each individual piece is possible that since the end of the sixteenth century this simple technique has not only been the favourite of Japanese amateurs but has made the strongest appeal to the Japanese tea-masters. Such craftsmen as Kōyetsu and



13. Japanese Raku Tea-bowl, by Koyetsu. Greyish brown, hand-modelled. This famous bowl in the Tokyo museum is an example of the austere and assymetric preference in the cult of tea.



14. Japanese Red-Raku Tea-Bowl, by Donyu, died 1656. Ochre brushed irregularly over a buff clay under a transparent glaze. Tong marks are clearly visible.

15. Japanese Raku Tea-Bowl by Koyetsu. Rosy buff clay under a semi-opaque glaze, hand-modelled. Attention should be given to the generous modulation of Koyetsu's forms.

Kenzan[1] valued raku for its artistic potentialities of surface texture and colour when used with characteristic restraint, its practicability for tea-bowls (because a somewhat thick and porous clay vessel is a bad conductor of heat and the bowl of hot fragrant tea could, therefore, be held comfortably in the hands), and for the comparative ease with which laymen of aesthetic sensibility could make their own pots. Two types, red and black,[2] are the most familiar. It will be seen from the illustrations that they are frequently modelled or cut by hand and not thrown on the wheel. The tea-masters, influenced by Zen Buddhist philosophy took a unique pleasure in this conscious return to direct and primitive treatment of clay. But living as we do in an environment of predominant symmetry of form and pattern, it is difficult for us Westerners to appreciate the subtle asymmetrical rhythms of these tea-bowls. Yet this very quality is one of the most valuable and characteristic in Japanese art, and it is only when such objects are seen in their native surroundings that their full value is apparent. Kenzan was among the first to use a variety of colours and he did so with great richness and restraint. The fine breadth of his calligraphy and brushwork was unequalled by any other Japanese potter except Kōyetsu, who was primarily a painter. His palette and glazes were handed on to me by my master, the sixth and last Kenzan of the Tokyo branch, who died shortly after the great earthquake and fire of 1923. The recipes are given in later chapters.

My connection with this line of potters came about almost wholly by chance. One day in 1911, two years after I had returned to the Far East, I was invited to a sort of garden-party at an artist friend's house in Tokyo. Twenty or thirty painters, actors, writers, etc., were gathered together on the floor of a

[1] Kōyetsu (*circa* 1558–1637), painter, poet, calligrapher, potter, lacquerer and sword expert, was perhaps the greatest of Japanese artist craftsmen. The painter Korin (1657–1716), and his brother, the potter and painter Kenzan (1660–1743), were greatly influenced by him.

[2] See Plates 13 to 17.

large tea-room; brushes and saucers of colour were lying about, and presently a number of unglazed pots were brought in and we were invited to write or paint upon them. Almost all educated Japanese are sufficient masters of the brush to be able to write a decorative running script of, to Western eyes, great beauty, and many of them can paint. I was told that within an hour's time these pots would be glazed and afterwards fired in a little portable kiln, which a man was stoking with charcoal a few feet beyond the verandah in the garden. I struggled with the unfamiliar paints and the queer long brushes, and then my two pots were taken from me and dipped in a tub of creamy white lead glaze and set around the top of the kiln and warmed and dried for a few minutes before being carefully placed with long-handled tongs in the inner box or muffle. Although this chamber was already at a dull red heat the pots did not break. Fireclay covers were placed on top of the kiln, and the potter fanned the fuel till the sparks flew. In about half an hour the muffle gradually became bright red, and the glaze on our pots could be seen through the spy-hole melted and glossy. The covers were removed and the glowing pieces taken out one by one and placed on tiles, while the glow slowly faded and the true colours came out accompanied by curious sharp ticks and tings as the crackle began to form in the cooling, shrinking glaze. Another five minutes passed and we could gingerly handle our pots painted only one short hour before.

As a result of this experience a dormant impulse must have awakened, for I began at once to search for a teacher and shortly afterwards found one in Ogata Kenzan, old, kindly, and poor, pushed to one side by the new commercialism of the Meiji era, and then living in a little house in the northern slums of Tokyo. By him I was taught how to make raku and stoneware according to the Japanese tradition. There is no doubt that most of the things described as the work of the 'First Kenzan' in our Western collections were really made by him or his immediate predecessor, Kenya, yet the old man, like all

craftsmen of the East, was lost when he departed from tradition and yielded to the influence of the West. Later on I made an agreement with him by which he was to build a kiln for me in my garden, teach me his traditional recipes, and coach me for a couple of years. Nine consecutive years I spent in Japan and China, giving more and more of my time to my new vocation, gathering ideas from every available source and putting them to the final test of fire.

Raku has two disadvantages which should be mentioned together with those qualities which obviously recommend it to the artist, the craftsman and the school; it is porous when new, and it is comparatively fragile. With use the pores of the body and the crackle of the glaze gradually fill up, so that even a raku vase will eventually cease to leave a damp mark behind it even on a polished surface. Its fragility, due to low temperature firing, necessitates the making of pieces with fairly thick walls, handles, and spouts. For this reason it is not advisable to make thin table-ware of raku. A harder preliminary firing of the biscuit will strengthen the body, but at a sacrifice of the peculiar soft character of the glaze and its crackle. The Japanese do make pottery of this kind, using soft coloured glazes over stoneware biscuit, and call it 'Kochi' (Cochin China ware), but it requires a kiln which will go to high temperatures.

The word *raku* ranges in meaning from ease, comfort, or enjoyment, to happiness, and comes from the ideograph engraved on a gold seal given in 1598 by the Taiko, who was an enthusiastic patron of the tea-ceremony, to Chōjiro, son of Ameya, a Korean who settled in Kyoto in 1525 and is said to have been the first to make this ware. Ameya was succeeded by his wife Teirin, who evidently had both ability and taste, for her tea-bowls attracted the favourable attention of the great tea-master Rikiu. Some years later, in 1578, her son Chōjiro, officially the first of the line of raku potters, was given a large order for tea-utensils by Oda Nobunaga, which had the effect of immediately making the ware fashionable. From that time on

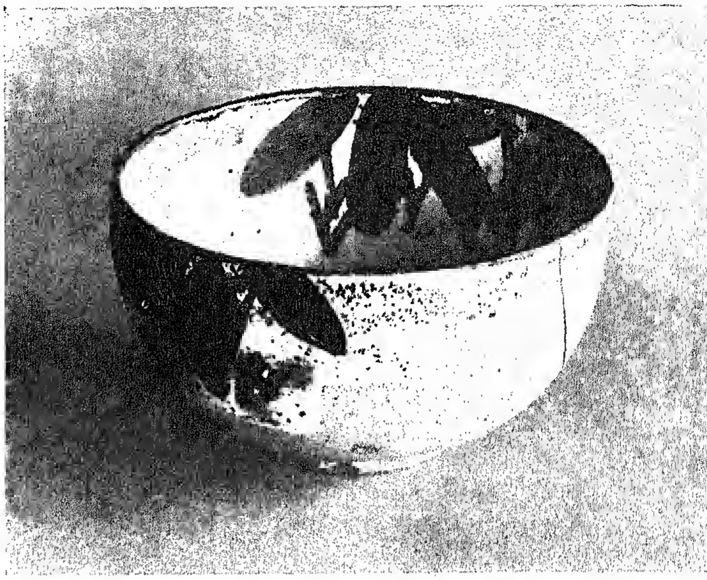
the line has continued without a break, and Raku Kichizaemon was making black raku tea-bowls in Kyoto a few years ago.

ENGLISH SLIPWARE

Although old English slipware is very unlike raku in appearance, the transition to a somewhat harder fired lead- or galena-glazed ware is not difficult. A visit to the Victoria and Albert Museum will show that the resemblance between the galena-glazed fragments from old Cairo and our slipware is no accident. Glaze, body and treatment are quite similar, and if the kindred Spanish, Italian, French, German, Pennsylvanian Dutch and Central European slipwares are taken into consideration, it becomes evident that this pottery tradition must have spread to Europe from various centres in the Near East.

The change in style from English medieval tiles and pitchers to seventeenth and eighteenth century slipware is very pronounced, and one can only conjecture that it was largely a result of the dissociation of the potters from their ecclesiastical and architectural background, following the dissolution of the monasteries and consequent scattering of their patrons after the middle of the sixteenth century. For from the beginning of the seventeenth century English pottery becomes at once more advanced in technique and less dignified. The nobility and strength of form of the pitchers of the fourteenth and fifteenth centuries and their uncommonly beautiful applied decoration disappeared with their Gothic environment. The peasant potter, faced by a growing popular demand, seems to have been thrown back upon his own rustic resources, especially in the second half of the seventeenth century, when pottery was beginning to come into general domestic use, and throughout the eighteenth century. More elaborate forms and decoration were invented, the glazes became thicker, the use of slip more varied, and pattern, now almost entirely trailed, often degenerated into

16. Japanese moulded Raku Dish by the original Ogata Kenzan. The broad, easy, yet dignified flow of Kenzan's brush may be recognized in the leaf pattern and in the writing in black on the subdued and broken colour of the background (see page 29, footnote).



17. Japanese. Stoneware Bowl by the 1st Kenzan. 1660-1743. Engraved iron pigment over broad touches of white slip on a buff body. Combined richness and restraint of pattern and texture (see page 29, footnote).

18. Japanese. Stoneware Ash-pot by the 6th Kenzan (in the possession of the author). Made about 1912. Pattern derived from 12th-century traditions in Korea and China.

unrelated intricacies or descended into the commonplace. Still, in so far as these essentially peasant pots kept their close connection with the soil, they remained healthy. The work of Staffordshire slipware potters, such as Thomas Toft, Ralph Toft and Ralph Simpson, and the Wrotham group, especially the best of their big dishes with figures, sometimes mounted, or animals or birds or coats-of-arms within a cross-hatched or otherwise decorated border, will always have an honoured place in ceramic history.

During my years in Japan the artist-potter Tomimoto and I carried many a suggestion from the illustrations in the late Charles J. Lomax's *Old English Pottery* into our early raku pieces. To him and to other Japanese potters, who were in the habit of depending almost exclusively on the brush, this new method of using clay was a revelation, and to-day there are at least half a dozen potteries in Japan where the slip-trailer is employed. The translation of the English idiom into Japanese is sometimes too literal, but that is the habit of the learner and corresponds to our own often too close following of Eastern example. That this art and pottery loving people on the other side of the world should value our pre-industrial countryside slipware so highly is significant enough. They too are reviewing in a long perspective the history of art and of ceramics.

When I returned to England in 1920 accompanied by Shoji Hamada, our first endeavour was to search for what remained of the English tradition. Books, museums and surviving country potteries, such as Truro, Verwood and Fremington were our chief sources of material, and gradually by adapting our previous knowledge of Eastern methods to those of the English slipware potters and through many experiments, one difficulty after another was surmounted. There was no one, for example, who still had the secret of 'combing'[1], but eventually we

[1] The extent to which combed oven-ware was used may be judged by the fact that we collected fragments of it for study from the harrowing of the fields opposite our pottery in Cornwall.

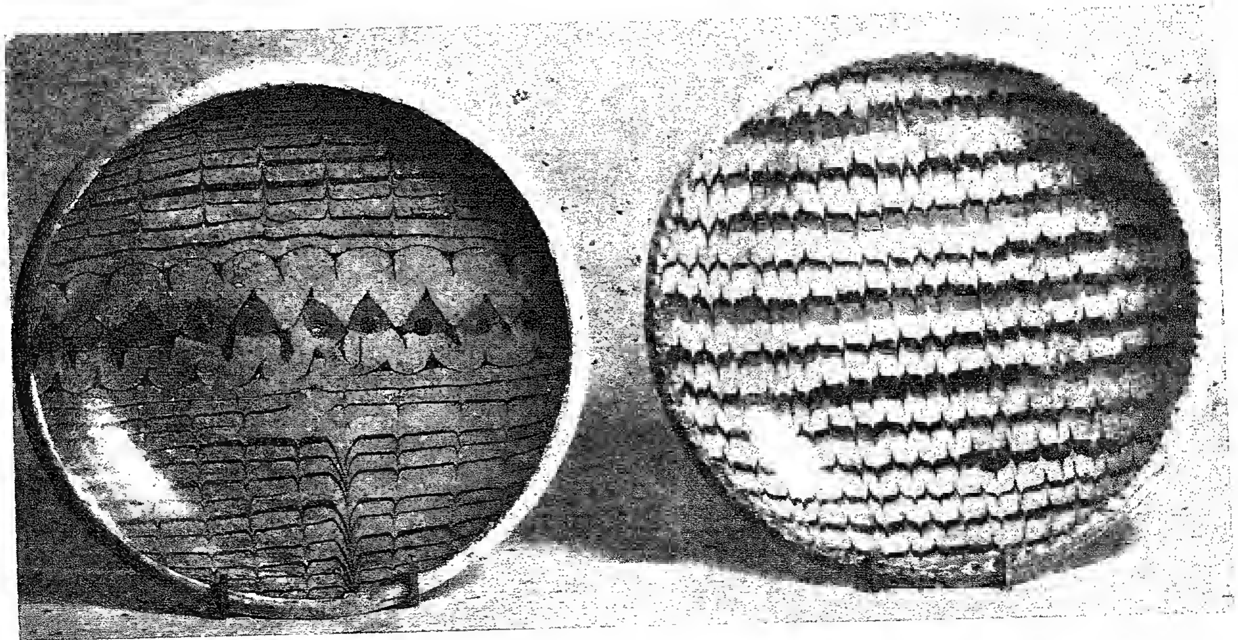
rediscovered most of the old technique, which I shall describe in later chapters.

Nevertheless, after the fever of technical research had abated, we saw that there were definite limitations to the use of slipware in present-day life. The softness and relative roughness of the ware relegates it for the most part to the kitchen and the cottage in the shape of casseroles, bowls, egg-bakers, honey pots, oven dishes, jugs, pitchers, basins and so forth, although its great decorative value opens for it the way to many other uses. But few people want red and brown or black or heavy cream-coloured ware for table use in modern cities. The slipware potter has his own following and does not desire to compete with Staffordshire.

SALT-GLAZED STONEWARE

It might be suggested that salt-glazed ware could offer another solution of the problem of pottery for the household, and it does indeed seem strange that except by the Martin brothers it has not in recent times been put to nobler use than for ink and ginger beer bottles and drain pipes. The Martins, together with William de Morgan, were the pioneers of the reaction against ceramic industrialism fifty years ago. But much as the ingenuity of the Martins in the use of the salt-glaze technique is to be admired, and their honesty of purpose in a lifelong struggle in the face of continuous poverty respected, I cannot remember having seen any work of theirs which could compare with the bellarmine illustrated in Plate 25. They lived at a time when craftsmanship in England was at its lowest ebb, and in only the more desperate case because few then knew it for what it was, and their energy was largely expended on twisted grotesqueries of naturalistic form and pattern, far removed from the simple dignity of the old tradition. But to-day when there is no longer public sympathy or demand for extra-

19. English 18th century trailed Slipware Dish by Thomas Toft. 'The Pelican in her piety'. Dark brown and brick-red slip on a cream base; yellowish transparent glaze. These plates are frequently over 20 inches in diameter.



20. Combed Slipware Oven Dishes made by the author at St. Ives. Red and white slip over black on a buff body with a yellowish galena glaze.

vagant and detailed ornamentation and curious and irrelevant naturalism, one wonders why, apart from Doultons, who towards the end of the last century revived the Lambeth tradition of applied decoration on commercial salt-glazed wares, although in an inevitably weakened form, some potter does not give us salt-glazed jars and vases, fruit and cake bowls, clean and sober in form and clay-like in throwing. The natural orange-skin surface of the glaze makes the ware unsuitable for table use with cutlery or silver, but for many another domestic use the colour, texture and hardness of this simple form of Western stoneware is admirably suited. How it originated in Germany about the fifteenth century seems to be as yet unexplained.

STONEWARE AND PORCELAIN

Stoneware is pottery in which the clay has been fired to the point at which it vitrifies. This takes place at white heat, but the exact temperature, say 1200°–1400° C., varies with the composition of the clay. Clays that contain much iron or alkali vitrify more easily than others. It is the melting together of the particles of which the clay is composed into one homogeneous mass that distinguishes stoneware and porcelain from earthenware. This explains its non-porosity (even when unglazed), its greater strength, and its clear ringing note, although if the body is coarse or the glaze very thick the sound may be deadened. Porcelain differs from stoneware in that its white body becomes translucent when vitrified. There is no sharp line of demarcation between the two, hence the description of some early Chinese pieces as proto-porcelain or porcellaneous stoneware.[1]

[1] If, for example, 10 per cent. of red ochreous clay is added to a porcelain body in order to give a good colour base for celadon glazes, it still remains 90 per cent. porcelain. The Japanese term *hon yaki* (truly baked) applies equally to stoneware and porcelain.

ignorance of the early Chinese wares until the second decade of this century, in part because the early Chinese forms and textures are in general not suitable for table-ware, which plays such a great part in modern production; but that the public is beginning to realize the inadequacy of enamel painting and crudely coloured flambé glazes for vases and other ornamental pieces, is evident from the interest shown in the early stoneware and porcelain at the recent Chinese Exhibition at Burlington House, although it is to be regretted that so many of the specimens shown there were selected more with an eye to rarity than to beauty. The retrospective view of Chinese art would have been of far greater interest if the domestic work of the people had been substituted for many of the *objets d'art* made to suit Chinese court taste, and which now appeal only to dealers and second-rate collectors.

Although the range of colour at high temperatures is limited, there is a satisfaction in stoneware and porcelain which no softer wares can give; and this, I should say, is due to more than the mere consciousness of technical difficulties overcome. In the case of porcelain obvious reasons for preference suggest themselves, such as translucence and fineness of material, but in stoneware the real explanation would seem to be determined by those standards of beauty which I have discussed in Chapter I. In the East stoneware and porcelain are usually fired together in the same kiln, and porcelain is only regarded as a refinement of stoneware and not necessarily as an improvement. The surface texture of stoneware glazes awaken the sensibilities of touch as no other pots do. We feel more than a satisfaction through the eyes. Unconsciously our fingers are invited to play over the contours, thereby experiencing pleasure through the most primitive and objective means. Children play with pebbles with a similar awakening of perception, and orientals have lost touch with the fresh wonder of childhood less than we have.

PORCELAIN

In order to familiarize oneself with what must be considered the ultimate refinement of pottery, one must go back to the early porcelains and examine the Ting and Ying Ch'ing wares of the T'ang and Sung dynasties. Here we find all the purity and strength of an inception. In later centuries command of material and range of expression increased, but never again did Chinese porcelain exhibit such noble simplicity of treatment, such fulness and clarity of form, such skilful potting without loss of virility, the tonality light and the decoration almost wholly limited to sharp incised or moulded patterns or delicate combings in the moist body, covered by transparent glazes.

Loyang, the capital of the T'ang emperors, had a population of three million, amongst whom dwelt from forty to fifty thousand Persians, Turks, Greeks, Arabs and other foreigners. These traders and missionaries, even including Nestorian Christians, introduced a variety of objects from the West, some of which directly influenced Chinese crafts. Certainly T'ang pottery was affected by imported metallic shapes. It is frequently jointed, rimmed at foot and lip, and has hard curves. But the Chinese had already developed a fine sense of formal relationship expressed chiefly in bronze, which in Han times had been in part translated into green-glazed wheel-thrown earthenware (see Plates 35, 36). It is thus comprehensible that when the foreign influences of the T'ang period had been assimilated, Chinese potters under conditions of peace and patronage broke away from severe formalism and settled down to full rich plastic expression.

Of all pottery that of the Sung period is most expressive of its material. It is in fact the purest of pottery. And if we consider it in the light of Sung culture as a whole, we cannot fail to recognize that at this climax the Chinese succeeded in making a rich fusion of external cultural influences with their own Taoist and

21. Large Raku Dish with a border in the Toft manner by the author, 1918. Red and black slip on a cream ground (see page 33).

22 and 23. Brown Slipware Jugs made at St. Ives.

Confucian ideologies, and that in the field of ceramics this resulted in superlative work.[1] The fame of these hard new wares travelled far, for fragments of Ying Ch'ing porcelain of the T'ang period have been dug up as far West as Samarra in Turkestan, with proof of importation during the seventh century. Chinese potters of the Sung dynasty were active in Annam and Cochin China as well as in Siam, and the Korean celadons of the twelfth century Koraï dynasty, which were greatly admired in China, again had their origin in Chinese prototypes.[2] The later development of Chinese porcelain was indirectly brought about by the conquest of China by Kublai Khan in A.D. 1280. Once again Western influences played a part in modifying native traditions, and Græco-Buddhist inspiration made way for Mohammedan. The outcome was blue and white porcelain, overglaze enamels, and single colour glazes. In general, the widening of colour range (sanctioned by the aesthetic of a very different philosophy of life) was accompanied by a loss of vitality and a hardening of form. Beautiful as many of these pots are, and the earlier are far more beautiful than the later, they are of another, lighter and more playful order of beauty, tending often to the extravagance of luxury (which became even more marked in the Ching period) and lack the power and dignity of their Sung predecessors. Ordinary Ming porcelain is apt to be heavy and sometimes opaque, but the native cobalt pigment yields a beautiful restrained blue, and the glaze has depth. The patterns of this period are for the most part floral or symbolic, with an abundance of conventional ornament and emblem, and sometimes exhibit a rather heavy formalism reminiscent to us Europeans of a similar quality to be seen in Roman decoration.

[1] At this point the student would be well advised to refer to an article in the *Burlington Magazine* for August 1934 by Ludwig Bachhofer on 'Characteristics of T'ang and Sung Pottery', in which he ably demonstrates the transition from the multiform co-ordinated unity of T'ang pots to the perfect and indivisible unity of Sung.

[2] See Plates 26, 34, 37.

After the Ming period the command of technique steadily increased; the bodies became thinner and whiter, the shapes less and less expressive of the material, the patterns more intricate and irrelevant, the colours harder and the glazes meagre. Even in China virtuosity began to displace virtue, and the famous Mohammedan blue of the time of the Emperor K'ang Hsi, obtained by use of a purer imported cobalt, instead of being an aesthetic achievement, was in fact only a technical advance. In the history of crafts which combine with artistry a process of technical evolution, these two quite different things are frequently confused with one another.

In Korea under the Ri (Yi) emperors (1392–1910), a thick but beautiful white porcelain was made, probably from the late fifteenth century, until comparatively recent times. It is painted with a pale sleepy native cobalt and sometimes with copper or iron. Although derived from Ming porcelain, it has a character of its own in material, form and pattern, as distinct from the Chinese as that of the earlier Korai celadons (see Plates 30, 31).

It is probable that the first specimens of Chinese porcelain reached Europe towards the end of the twelfth century, but apparently not until the early sixteenth century did any known examples (celadon and blue and white) find their way to England. The impression made by the blue and white translucent pottery must have been very strong upon peoples accustomed only to comparatively crude earthenwares, and although attempts to imitate the Chinese porcelain were made in Italy and France, etc., at various times during the sixteenth and seventeenth centuries, only glassy substitutes, perhaps based on the translucent wares of Persia (as for example the Medici Ware, 1575–85), were produced until about 1710, when Böttger succeeded in manufacturing true porcelain from the proper materials at Meissen. Some of the soft-paste glassy porcelains bore an astonishingly close superficial resemblance to the Chinese, but all were fired at a much lower temperature and none stood in any relation to porcelain in

composition.[1] Even after the Chinese method was understood and china clay and china stone had been made available (in England by Cookworthy in 1768), porcelain never entirely supplanted the various soft-paste glassy bodies which were the outcome of the earlier experiments. Different types of body were developed in Germany under the influence of Rococo art and under French court patronage at the Sèvres factory, which towards the end of the eighteenth century set Europe a standard of flamboyance and unsuitable naturalistic decoration more debased than even the most eccentric Ming pottery had ever dreamed of being, and as far removed from the restraint of the Sung potters as is possible to conceive. Chelsea and other English potteries followed suit, for towards the end of the eighteenth century and at the beginning of the nineteenth French porcelain was almost extravagantly admired in England. In the meanwhile, beginning at the Bow factory in 1750, bone ash began to take the place of the glassy ingredients of soft paste, and thus a new intermediate type of porcelain, more easily fired than true porcelain and hence more suitable for domestic use, came into existence—the bone china, finally perfected by Josiah Spode in 1800, for which England obtained a great reputation during the nineteenth century. Hard porcelain, after a short period of manufacture at Plymouth and Bristol, was given up in England in 1781; but it has been continuously produced and developed on the Continent at Sèvres, Berlin, Meissen and Copenhagen.

[1] The development by the Dutch of the tin-enamelled earthenware tradition, which had spread north and east (to Italy) from the Moors in Spain, shows many remarkable instances of imitation of blue and white Chinese porcelain. Delft has a buff clay body covered with an opaque white stanniferous glaze which is fired at low temperature in an oxidizing atmosphere and somewhat resembles a feldspathic alkaline glaze. On this glaze the painting is done. Sometimes the piece is covered with a second coating of lead glaze. To the eye the result, especially when the design in blue is copied from a Chinese model, is often extraordinarily like its original, although being earthenware it has neither the hardness nor the translucence of the porcelain. Tin enamel was made in Syria, Egypt and Asia Minor as early as the sixth century.

The higher temperature at which it must be fired increases the cost of production and the risk of loss in the kilns, and compared with soft-paste the gain in strength is offset by a coldness in colour and a hardness of glaze surface in which enamels do not sink.

At the present moment we seem to have arrived at a parting of the ways. A new architectural and decorative impulse is sweeping steadily through Europe. It is the expression and acceptance of the machine age and no longer a reaction from it. Its major effect upon ceramics so far has been in favour of simplification of design within the limitations of material as conceived by industry. For this much we should be thankful but not content. The accent on geometric design is not one which lends itself readily to the potter even under industrial conditions. To the deadness of technique to which I have called attention is added a further deadening of concept. Such pots as have already been produced under its influence are not very inspiring. Good pottery imposes limitations of form and pattern which are themselves sufficiently abstract. What is needed is a humanizing influence, and it will be provided by the growing appreciation of those qualities in Sung and other pottery with which this book deals. Pottery has reached the summit of its technical evolution. There is no further stage beyond porcelain, so, of necessity, development must be sought in other than purely technical directions. Creative art invariably expresses the spirit of its age, and ours is one which despite its indecision is feeling towards a human synthesis. We are being forced both individually and nationally to review the past and select from it the best. If we lay great stress upon Sung pottery it is not because we shall be content merely to imitate it but because it offers the highest and most universal standard with which to vitalize the technical achievements of the West.

24. Galena glazed Slipware by Michael Cardew. Large black cyder jar and basin; the former with cut-away glaze pattern and the latter trailed with white slip. These pots have breadth and are the most vigorous contemporary expression of the English countryside.

25. German salt-glazed Bellarmine or Greybeard, 17th century. Vigorous European form and a severe Byzantine seal pattern admirably adapted to the leopard-like mottlings of the 'reduced' salt-glaze (see page 34, footnote).

Chapter III

CLAYS

A potter's prime need is good clay. Whether he be industrial, peasant or studio potter the raw material of which pots are made is of fundamental importance. Upon the quality of the clay depends the strength and still more the character of the finished pot. Eastern potters, whether by design or accident, have generally used clays which when fired respond pleasantly to the touch, whereas Western potters from the early days of industry, and especially in making porcelain, have travelled further and further away from a natural conception of clay towards an ideal of over-refined mixtures which are aptly called pastes. Up to a point this has been a necessary tendency in the stages of standardization, but in so far as it is a survival of the superficial court taste of the eighteenth and nineteenth centuries the sooner we return to a healthier understanding of clay and melted stone the better. To dig a single clean clay in the vicinity of the kilns was the habit of the old country potters, and it is one which can be recommended to the studio potter of to-day. It is true that freightage of clay is a comparatively small item in his yearly budget, but contact with the source in nature of his clay, pigment, and glaze materials gives a potter more control and scope for the taking advantage of the variations which nature always offers. He should not want to standardize, or to depend entirely upon those reliable but uninteresting substances which the potter's merchant offers to the trade. What usually happens is that the studio potter in search of

quality is forced by ignorance or convenience to buy standardized raw materials and then to introduce impurities artificially in order to obtain, not nearly so successfully, what he might have had direct from nature.

Nearly all clays are products of the decomposition or erosion of feldspathic rocks which make up such a large proportion of the earth's surface. Such formations are known as *mother-rock* of clay. *Feldspar*, with which one is familiar as the rectangular white crystal set in common granite, contains sufficient alkali to cause it to melt into a sluggish semi-transparent whitish fluid at about 1300° C. *China stone* (Cornish stone or pegmatite) is a variety of feldspathic rock closely resembling pure feldspar and melting at a slightly higher temperature. These two stones are extensively used as a basis for high temperature glazes and together with china clay are the chief ingredients of true hard paste porcelain. The natural decomposition of granite frees the feldspar of its alkaline content and the resulting *china clay*, or kaolin, is found in enormous deposits in various parts of the world, especially in Cornwall.[1] This primary clay is found near its mother rock. It is an invaluable material for potters because it withstands very high temperatures while retaining its colour. Without it the majority of our domestic wares could not be made. It is composed of silica, alumina and water, and is called by chemists alumino-silicic acid. In its theoretically pure form it has the formula $Al_2O_3,2SiO_2,2H_2O$, the average composition of which is: alumina 39·45, silica 46·64, water 13·91. Most clays do not contain much more than 50 per cent. of this *pure clay* substance, but china clay may have as much as 95 per cent. As might be expected china clay is seldom plastic.

The causes of *plasticity* in clay have not yet been fully explained. For our purpose, however, we may assume that it is dependent upon the quantity and the minuteness of the particles

[1] The great white conical heaps to be seen in Cornwall, erroneously thought to be china clay, are actually composed of refuse—quartz, mica, and fragments of undecomposed feldspar.

of pure clay present. The other substances may roughly be described as fine sand. The flat, or lamellar, form of these microscopic grains of clay sets up a strong molecular attraction in the presence of water, and, furthermore, the salt or acid nature of the water combined with the clay seems to be responsible for a sort of colloidal, or gelatinous, lubrication which adds to the total effect of plasticity.

Ball clays[1] are similar in composition to china clay but are far more plastic. They contain some soda or potash of vegetable origin which lowers their vitrification point and accounts for their varied colour in the raw state. This colour, however, disappears in the kiln, leaving a creamy or light greyish body. *Secondary clays* are the result of china clay having been carried by water further from its source and having gathered impurities on the often long journey to their final sedimentary beds. As the impurities can be of many kinds, so the range of secondary clays is wide. They may be classed as refractory, vitrifiable and fusible. *Refractory clays*, among which fireclays are to be included, will not vitrify at 1400°–1500° C. *Vitrifiable clays* tend to fuse at hard porcelain heat, 1350° C. Of these the alkaline type is generally used in England for stoneware. *Fusible clays*, the most widely diffused of all, for they can be found in every country, lose their shape at 1200° C. or less. The commonest varieties contain iron, and fire orange red to brown at upwards of 1000° C. Red bricks and tiles are familiar examples of its use; most primitive and peasant wares are made of it. *Ochre*, so useful for slips and pigments, with which should be associated the umbers and siennas, is a smooth and often highly plastic variant. It contains a higher percentage of red iron oxide, and is sometimes used to make a kind of unglazed low temperature stoneware.[2]

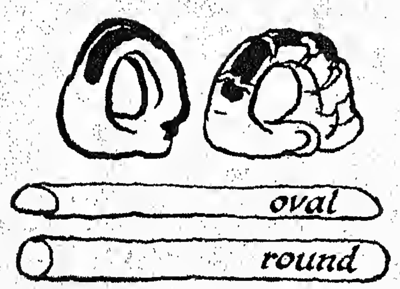
[1] So called because the lumps of Dorset clays formerly carried by mules from the coast to the Potteries resembled footballs.

[2] Chinese Y-hsing ware and English Eler's ware are examples.

Local Clays and Sands

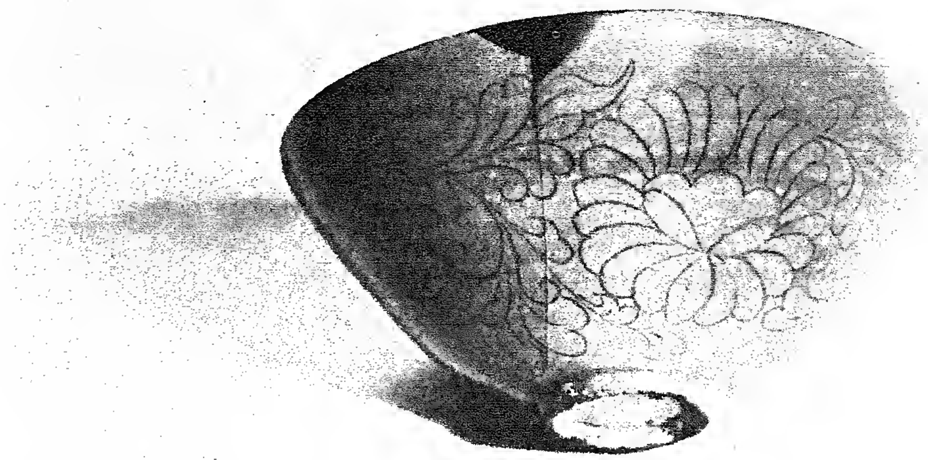
There is no comparison between the satisfaction of finding one's own local clay bed and that of buying a ready-made article. Although more trouble may be involved in obtaining first-hand knowledge of the geological resources of one's own locality and of selecting what is needed according to texture, colour and composition, the attempt should not be lightly abandoned. This is not only true for the studio potter but also for any boy or girl in those schools where craftsmanship is considered to be of educational value. It may also be added that as a rule it is possible to obtain such local materials for little more than the cost of the labour. If there are no brick works or clay pits in the neighbourhood local masons, miners, well diggers or geologists should be consulted as to the whereabouts of sticky clays and fine freshwater sand. Builder's sand often contains a large proportion of silica, which enables it to stand high temperatures, and it is therefore extremely valuable for 'opening' an otherwise too smooth clay.[1] Its addition not only gives a pleasanter texture but also counteracts excessive shrinkage, warping and splitting.

Samples of clay when brought in, if fairly free from impurities such as gravel, roots, dead leaves, etc., should be damped down under wet cloths until soft, and then rolled between the palms of the hands, doubled and re-rolled for a few minutes to obtain a fairly even consistency. These rolls can be cut into pieces about three inches long and one-third of an inch thick, and then bent into rings with the ends overlapping and flattened with one finger on a dry table to form



Test rings

[1] Builders distinguish between 'sharp' and 'loamy' sands: the latter mix better with a too fat clay.



26. Small Korean Celadon Bowl. Korai Dynasty (in the possession of the author). Repaired with gold lacquer; quartz spur-marked foot. The freedom and lightness of touch of the Sung pattern engraved on the green-hard clay makes an exquisite motif on the shell-like curve.

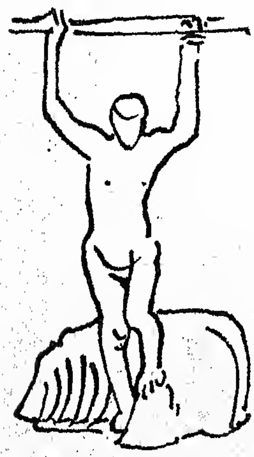
27. Annamese Stoneware Bowl, 13th century, showing the influence of Sung Potters.

bases for them to stand on. If the rings split in bending, it is an indication that the clay is too 'short' for throwing purposes, and had better be discarded unless mixed with a more plastic clay. The next step is to dry the rings thoroughly and fire them up to the temperature and atmosphere necessary for the kind of ware desired. For this and many other purposes a bench test kiln is almost indispensable (see Chapter VIII, p. 244). It will thus be possible to get an idea of the colour the clay will give under clear glazes, its contraction, and its resistance to heat.

PREPARATION OF CLAYS

Potters' clays are improved by *weathering*. The clay is spread in an eighteen-inch layer and exposed to sun, wind, rain and frost: the sun and wind dry and crack it, the rain beats into the crevices and soaks through, and in winter frost nets its surface with a thousand fine veins of ice. Every few months the entire mass should be turned over with a shovel to expose fresh surfaces. All this helps materially in the disintegrating process by which the actual clay substance, and thereby the plasticity, is increased. Provided the clay does not contain major impurities it can then be moistened with lime-free water and mixed by hand, foot, or pug mill to the right consistency for throwing. If too full of impurities for direct use, a batch should be thoroughly dried and weighed. Any other clay with which it is to be combined must be treated in the same manner. The two (or more) clays are then churned with water and the resulting liquid passed through sieves of varying mesh. The clean slip is allowed to settle, the water is drained off the surface, and the mass of soft clay is slowly dried to the consistency at which it can be kneaded up for storage and use. Evaporation of the slip can be hastened by moderate heat or filter presses, but it should be noted that too much heat destroys organic life in the clay and reduces plasticity, and also that clay hardened by filter presses

is less plastic than if prepared in the more leisurely old way. Clay is improved by long storage; it gains in plasticity, its decomposition continues, it changes colour, and may even begin to stink. I have been told of old potters who speak of such matured, or soured, clay with the quiet impressiveness of epicures discussing vintage wines. Immediately before use it should always be mixed again. This is done in factories by pug mill, but the result is not so good as by wedging, or kneading with hand or foot. In Japan it is said that the slow pressure of a man's heel working rhythmically in a rotary movement, as he steadies himself with a hand on a beam overhead, gives the best results. *Souring* and *kneading* cause the flat particles of clay to lie close together and in more parallel directions, thus increasing the molecular attraction and therefore the plasticity. If the impurities removed from the clay mixture by sieving are of any considerable bulk, it will be necessary to treat each clay separately, and to compensate for loss before the slips are combined. The chief *impurities* in clays consist of magnesia, potash, soda, iron, lime, and carbon or vegetable matter. Lime, or calcium carbonate, absorbed from water, decreases plasticity, and magnesium carbonate acts in a similar way but occurs in much smaller proportions in clays. In industry iron is removed from slips by means of electric magnets.



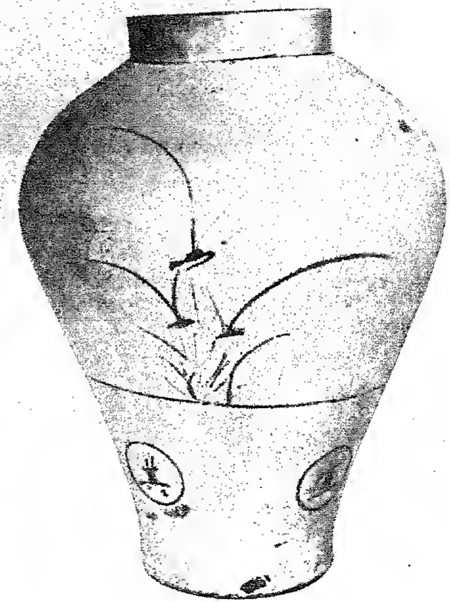
Clay kneading by foot

It may be useful to describe in greater detail and by means of drawings the methods which we employ at St. Ives in the preparation of slipware and stoneware clays. After weathering we dry out batches of local clay and weigh them. These are then mixed with water in a barrel by the use of a *dolly* to a slurry

28. Chinese Stoneware Jar of good plain form, Sung Dynasty; cut paper pattern.

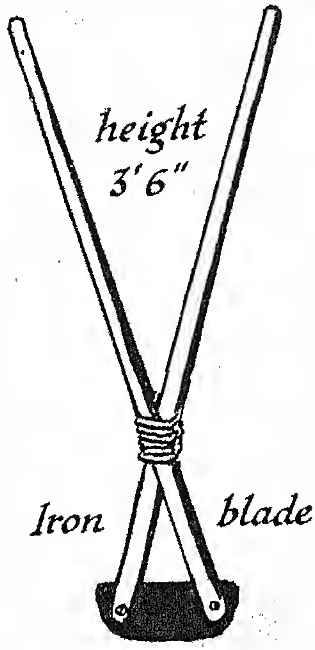
29. Small covered Stoneware Pot. Swankalok, 12th to 13th centuries. Here is an attractive ceramic expression which forms a link between Indian and Chinese cultures.

30. Detail from a Jar similar to Plate 31. Touches of underglaze copper red complement the sleepy blue of the native cobalt.

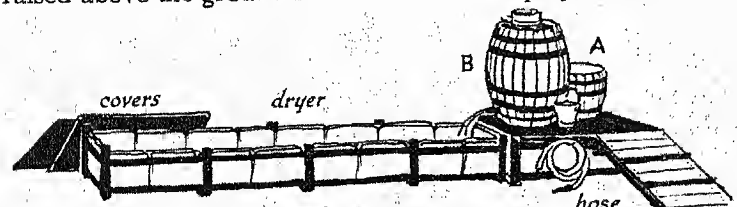


31. Large Korean Porcelain Jar, painted in underglaze blue. Early Ri Dynasty, 15th to 16th centuries. The character of Korean line and shape is a noticeable elongation of Chinese.

condition, i.e. that of thick rough slip. This barrel A is kept with one other B on a platform. A sieve of 60 mesh is laid on two bars over the top of barrel B and the slurry is ladled through it. The sieve is tapped with a padded bat horizontally. Sticky accumulations are dispersed by spurts of water from the small nozzle of a hose pipe, or returned to barrel A, and only grits are thrown aside. Each morning the clear water which has accumulated in barrel B is siphoned back into barrel A and the slurry is re-churned with the dolly. As soon as barrel B is full of smooth thick slip the contents are let out into one of two long parallel *troughs* made of fireclay bats 18″ × 12″ × 2½″.[1] These troughs are held together by light wooden frames and the bats are luted at the joints with cement. Stiff clay is used to repair any cracks which may appear later. The troughs are slightly raised above the ground so that air has free play all round the



'Dolly' or glaze mixer

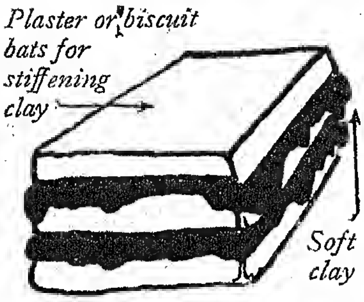


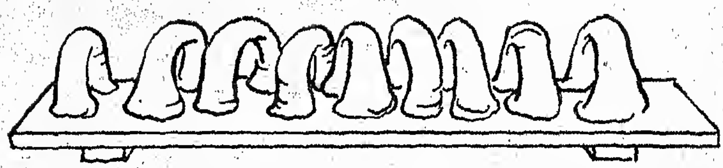
Clay sieving

dryer to evaporate the moisture which is sucked out of the slip. Flat galvanized covers, six feet by two, are placed on the

[1] Plaster may also be used, or, better still, soft biscuit bats.

troughs to keep out rain, dust, and dead leaves. The slip hardens sufficiently in a fortnight for kneading purposes. Sometimes we use one trough for one clay mixture and the other for another. Our troughs are about twelve feet long, one foot deep, and one foot wide, and each will provide enough clay for about 300 pots, roughly 500 lbs., which is the equivalent of 300 lbs. of dry clay. In Japan it is more usual to have a group of three barrels for sieving, so that a man can be kept continuously at work, sieving into one whilst the other settles. Repeated use of the same water is advised by Japanese potters on the ground that it assists the colloidal formations in the clay, in other words, makes it more plastic. When the clay is removed from the troughs it is usually too wet in the centre and too hard on the edges. The hardened parts



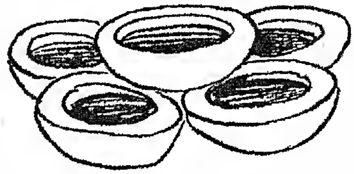


Drying soft clay in sun and wind

should be embedded in lumps of soft clay and left to equalize; this can be done in thick plaster bowls, between absorbent bats, or by exposure to sun and wind. The clay is then ready for thorough mixing. Large quantities are most conveniently put through a pug mill working on the same principle as a meat mincer.

Wedging is done by taking a lump of clay of, say, 60 lbs. weight and putting it on a strong table with a top either of

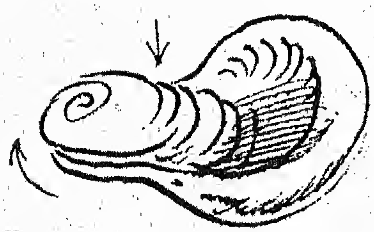
plaster or smooth slightly absorbent stone, like slate, in such a way that half of it projects over the edge of the table. It is then cut in two with a piece of brass wire about two feet long with knobs at each end by an upward slice at full arm's length from the knee. The projecting half of the clay is then turned over and lifted with both hands above one's head and brought down with its full weight on top of the other half, so that the two cut surfaces lie one above the other facing the operator. The two joined clay masses, after being smacked together all round, are turned over, given a half turn, and pulled forward into the original position, with about half projecting over the side of the table, and the entire process of cutting in two, etc., repeated for about a quarter of an hour. Thus some fifteen minutes' hard work is involved in preparing sufficient clay for about thirty pint size vases or jugs. Repeated *cutting* of a lump of clay with a fine wire, before wedging, will disperse small hard lumps. Twenty cuts and then a re-arrangement of the thin slices should be repeated five or six times.



Plaster or biscuit bowls for stiffening clay

Kneading

The Japanese knead their clay by a two-handed rotary movement with the weight of the shoulders coming down rhythmically on the right wrist. Fifteen to thirty pounds of clay are handled at a time; the clay is turned slowly clock-wise, mainly by the left-hand, the right hand taking a fresh hold after each pressure and release. The effect is to move the clay on



The spiral movement of the clay in hand-kneading

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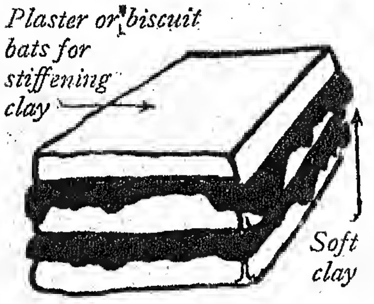

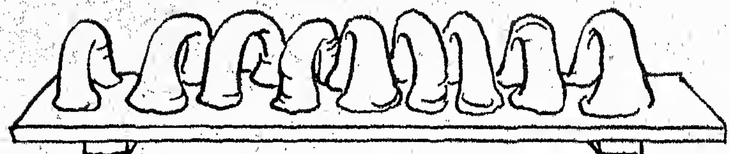

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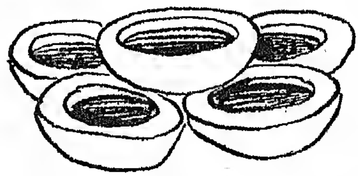

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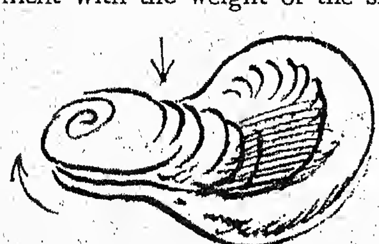


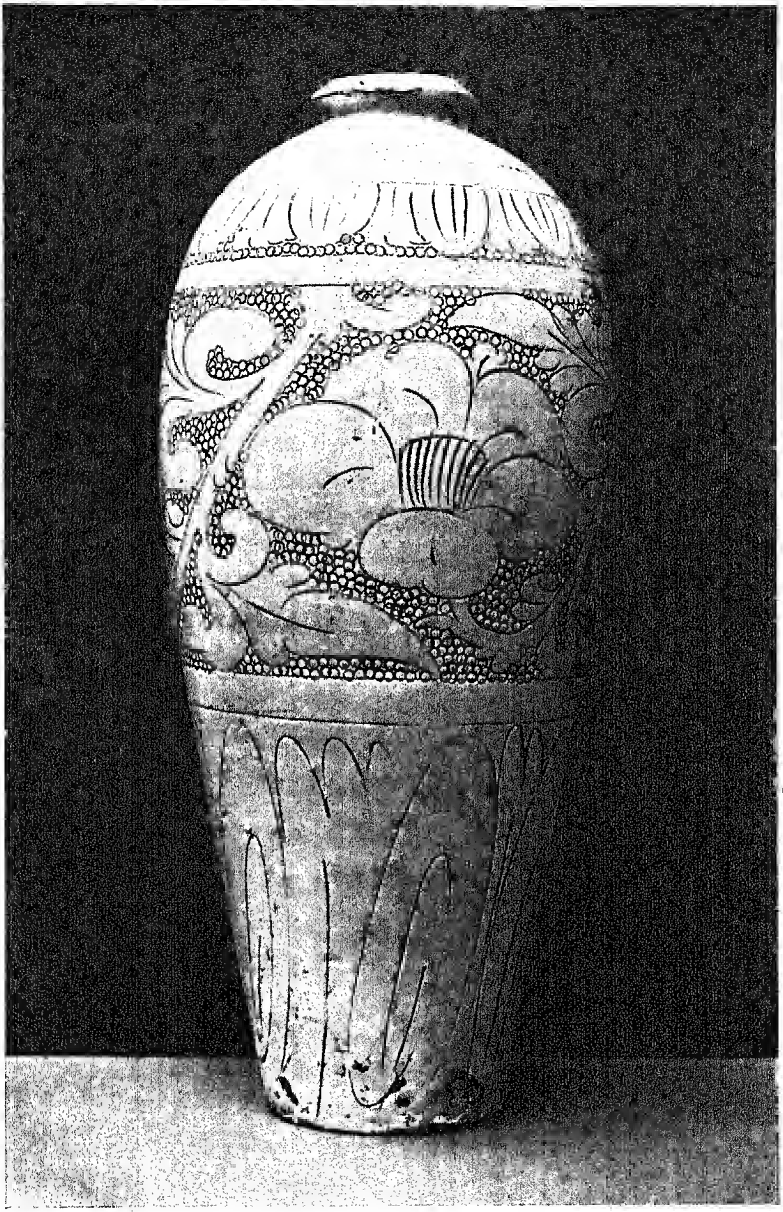
The spiral movement of the clay in hand-kneading

the outside towards the centre of the mass whence it works out slowly to the circumference again. A hundred to a hundred-and-fifty turns, taking about five minutes, is sufficient to squeeze out all the air and thoroughly temper the clay. The right-handed movement is suitable for a wheel which also works clockwise. In England it would be better to learn to knead with a left-handed action so that the twist would be with, and not against, the subsequent wheel motion. This only applies when a single pot is made out of a kneading. It takes a few days to get the knack of it, but once acquired it is the best method of kneading small quantities of clay preparatory to throwing. For studio work I advise wedging before and kneading after storage.

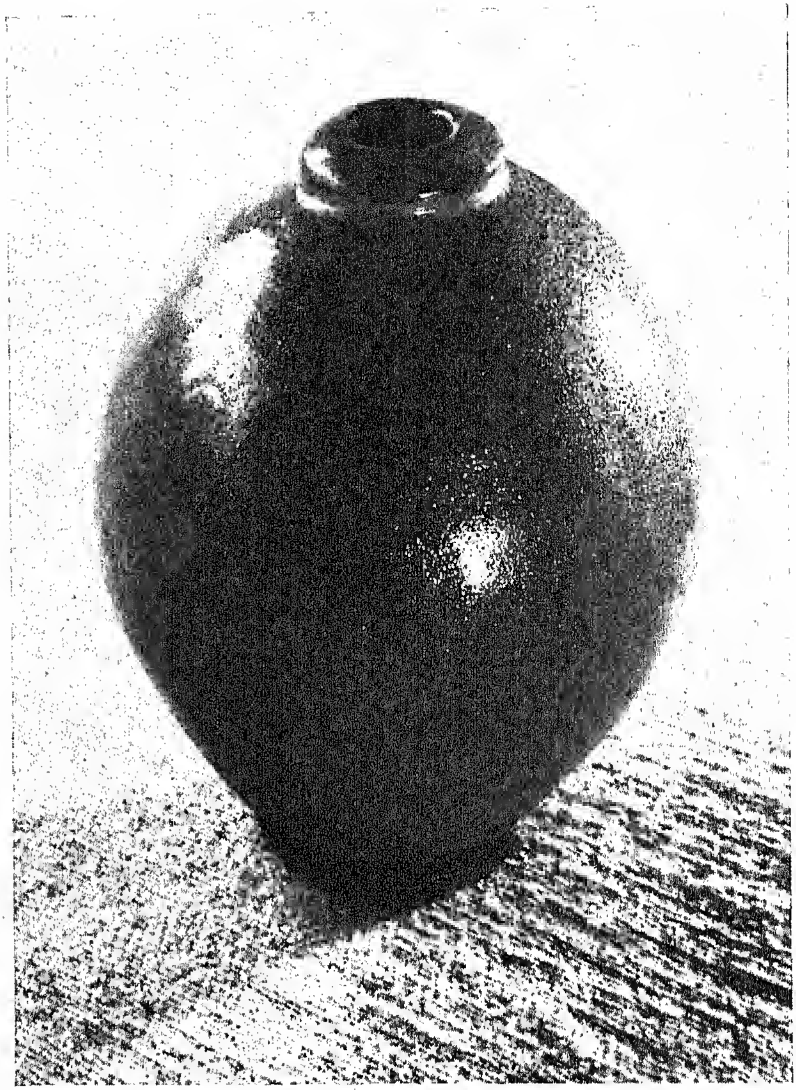
Japanese clay-kneading by hand

Storing

The clay should be stored and soured in a cool damp place. For small quantities an ordinary dustbin is very convenient. If a two-inch floor of plaster of Paris is set in the tin, it can be dampened with water in order to keep the clay moist. Even then it is advisable to place a wooden bat at the bottom on which to rest the balls of clay, to prevent them from sticking and leaving small pieces only to harden and be picked up by the next filling. Larger quantities can be kept in a cellar, or a brick box, and



32. Chinese Sung Tz'ou Chou Stoneware Bottle. Sgraffito pattern, oxidized firing. The background has been impressed by a small bamboo tool, probably the wrong end of a brush. The form is perfect and the drawing clean and spirited although the conclusion of the pattern on the shoulder may be open to criticism.



33. Large Stoneware Jar by the author. Light olive mottled Chün glaze.

treated in a like manner. If the clay is covered with wet cloths these should not be used too long as they quickly rot and leave hairs and shreds on the clay.[1] Lumps of clay which have become too hard for use can be smoothed over the surface and soaked overnight in a bucket of water. After a few hours they absorb sufficient moisture to allow of re-kneading.

SLIPS

The fluid made by mixing dry clay and water in about equal proportions is known as slip, or engobe. A pot after having been allowed to dry to leather hardness, can be covered with this slip by the same methods as are used in glazing. A slip adheres well when its contraction, during both drying and firing, is approximately that of the body of the pot to which it has been applied. For this reason it should be composed of as much of the clay used in the body as the difference in colour permits. Bodies to be covered with slip are usually intermediate in colour, and for this reason dark slips do not present much of a problem; but when a red or grey body is coated with a white slip difficulties are often encountered. *Slips which peel or flake off*, especially on the thin edges of cups, bowls and handles, do so because they have been left behind by the greater contraction of the body. In raw glazing this tendency is still more pronounced, and here it is less easy to correct the fault. With slips it is either a question of adding more plastic and contracting material to them or more refractory elements to the body. We have experienced little trouble in using slips of too great plasticity with rough textured clays; at worst a series of fissures or cracks will develop in a thick line of pure ochre trailed over a refractory raku body, but even then the slip adheres. If it should prove difficult to obtain a white slip clay with as high a rate of con-

[1] The life of such cloths may be prolonged by an occasional soaking in a weak solution of alum.

traction as the body, and for one reason or another it is undesirable to alter the body, *the pots can be biscuited and then dipped in slip* of a not very plastic nature. Thus at St. Ives we coat refractory stoneware tiles which have been biscuit fired for us elsewhere at 1200° C. with a dip of:

China clay	6
Ball clay	2
Feldspar	2

In this case the feldspar is added in order to help the primary clay adhere by a slight fluxing or vitrification.

Slips of various colours can easily be made by the addition of metal oxides or body stains. We make a black slip which can be used equally well on our slipware and stoneware bodies thus:

Dry slipware body	7
Red iron oxide	2½

Our *White slip*—Pike's siliceous ball clay, G.F.S.
Our *Red slip*—Pure local raw ochre.
Our *Red-brown slip*—Made of the slipware body.

SLIPS FOR STONEWARE BODIES

The slips suitable for high temperatures differ from those used for lower temperatures only in so far as the colour range is more limited and the clays of which they are composed must be more refractory.

White slip is made of china clay and white ball clay proportioned to suit the body shrinkage. Feldspar is added sometimes to help adhesion by its fusibility.

Black slip: The same as for slipware.

Coloured slips: Oxides of cobalt, chromium, iron, copper and manganese, in a very fine powder form must be very thoroughly mixed with either white or red slip to give blacks, browns, blues and greens. The order in which they are mentioned is that

of their strength, but it is not possible to tabulate oxides with exactness because the depth of colour each will impart to liquid clay depends upon the preparation of both oxide and slip. One per cent. in the case of cobalt may be the equivalent of ten per cent. of manganese. The finest oxides are chemically precipitated; those commonly used by potters are water ground.

It will be of advantage to compare these notes on the colouring of slips with the equivalent remarks on pigments and glazes in Chapter VI.

Settling

All slips have a tendency to settle in their containers, and often to gather together in small hard lumps or to dry on the sides of the tub, and afterwards fall back into the liquid in flakes. Consequently slip must not only be stirred well before using, but if necessary it should also be run through a sieve.

The *consistency of slips* is partly a matter of taste, but the thickness as recorded by a slip gauge should be noted down to enable one to repeat a former effect.

Specific gravity

Attention must also be called here to a fact, familiar enough to experienced potters, which may be overlooked by beginners, namely, that the weight of the clay content of various slips of equal consistency will not necessarily be the same. Thus accurate records should be made of the properties of the various materials in use in a pottery if consistent results are expected.[1] Laboratory accuracy is very irksome to the craftsman and artist, but this intermediate workshop carefulness and clearness is essential.

RAKU CLAY

The clays used for making raku ware must be able to withstand sudden and violent changes of temperature, and this end

[1] See description of a slip gauge on p. 228

can be secured by the very simple means of mixing with the ordinary clay hard burnt and re-powdered fireclay known to potters as *grog*. When clays are subjected to heat they lose both their free and their chemically combined water, up to 30 per cent. of the former at about 100° C., and between 3 and 13 per cent. of the latter between 350° and 700° C. These are the first two causes of contraction, and they are responsible on the average for a 10 per cent. shrinkage. By the introduction of quartz, flint, sand and, especially, grog, the contraction is lessened and at the same time the pores of the clay are opened to allow the moisture to escape more easily so that it will no longer tend to burst its imprisoning walls. Raku bodies are usually made of a plastic white clay, to which the grog is added. The latter may be coarse or fine according to preference, but the proportion used is seldom less than one-third of the whole mass by bulk. If too much is added plasticity is lost. In many localities it is impossible to find a plastic white firing clay, and in such cases one has to buy stoneware clay and grog, or fireclay such as is used in making saggars. I have found Pike Brothers' (of Poole) siliceous ball clay excellent for this and other purposes. E. J. & J. Pearson & Sons (of Stourbridge) sell good saggar clays. The last named firm add to the Stourbridge clay as dug a considerable proportion of grog, so that by adding a little more when kneading, it is very easy to obtain a satisfactory raku clay. The Stourbridge fireclay, as a mixture for rough purposes, has the advantage of not being too refined. As a rule one should use a more finely screened grog for small and delicate pieces, and a supply can usually be arranged for with the firm that sells the fireclay. If one is making one's own body, it is best to keep several grades of grog, such, for example, as have passed through 8, 16, and 32 mesh. It is less important to prepare raku clay by the wet method. The dry powdered clay may be mixed with water, kneaded, stored for a few days and re-kneaded before use, as the pores are kept more open by this treatment. There is no reason, other than aesthetic, why raku

bodies should be white. A red or buff firing clay may be used provided it gives good effects, but the Japanese prefer to obtain the beautiful brick red and salmon colourings of their raku tea-bowls by several brushings of thick raw ochre slip over a white body. The white under the red gives greater brilliance and variety of tone.

SLIPWARE BODIES

English slipware is usually composed of a local red or buff secondary clay, to which siliceous sand or quartz powder is sometimes added. The old peasant potters and their public were not very sensitive to porosity, but to-day it is important to use a fine textured clay which will vitrify sufficiently at about 1050°C. to prevent leakage. If this proves difficult it is advisable to raise the melting point of the glaze, by the addition of quartz or clay, to the point at which the body becomes impervious, say, at 1100° C. This also tends to prevent crackle or crazing in the glaze.

The best clay of which I know for slipware is dug by Mr. Charles Holland of Tawstock, Fremmington, North Devon. This is the clay used by the potters of North Devon from the earliest times to the present day and until recently by Michael Cardew. I obtain my red clay from a local pit which also yields various grades of sand, a fusible white clay, and very good ochre. Our slipware body is composed of:

St. Erth red clay	61	Dry
Water ground quartz	23	
Porthia china clay	16	

The china clay is introduced to lighten the colour, to fill the interstices and to cause the mix to resist a higher temperature.

Most red clays used in brickworks are suitable for slipware if sufficiently refined. Even calcareous clays, or marls, may be

used provided the limestone or chalk fragments are small, for pieces no larger than bird-seed will absorb moisture after the pots have been fired and throw off chips of clay, exposing themselves as white nodules in the fracture. At higher temperatures they act as a flux and combine with the body.

The red secondary clays of which I am speaking contain up to about 8 per cent. of iron oxide, which gives them their colour; but there is no need to avoid other clays, provided they are not too porous. I make my large trailed Toft dishes and combed oven-ware with raku clay for the reason that owing to its refractory nature it withstands warpage, and I find a light body with red and black slip trailing a pleasing alternative to white slip trailed on a red or brown body. In my round kiln dishes measuring from sixteen to twenty-two inches have to be fired upside-down on stilts.[1] It is true that the fireclay body remains porous at 1050° C., but as these large dishes are not intended to hold liquids, this is no great disadvantage.

Our *Deep cream slip*—A mixture of white and red-brown.

Green slips can be made by adding 2–6 per cent. of black copper oxide to the white slip.

Blue slips can be made by the addition of black cobalt oxide finely ground with ten times its weight of dry white slip, this is then thoroughly mixed with another 85 to 90 parts of dry white slip, but since cobalt is the strongest of colouring oxides I prefer to mix it with red slip which gives it a modified and slightly granulated effect.

Provided the slip fits the body, it can be applied either thick or thin. Thin effects are often very pleasant because they allow the body to show through irregularly after firing. Slip may be thickened in its container by the addition of a little acid such as vinegar. The thickest effects are obtained by the use of a trailer, as in the old Toft wares. If flat trailed lines are preferred the trailed slip can, when it is set, be rolled, or beaten into the

[1] This is to assist the passage of the flames over difficult horizontal areas.

leather-hard body, thus forming a sort of inlay with fat rounded edges. The use of slips for combed and marbled ware is described in the chapter on decoration.

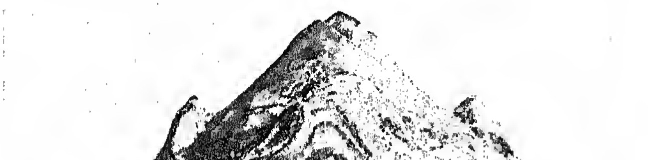
STONEWARE BODIES

The high temperature at which stoneware is fired limits the choice of material. Fusible clays suitable for slipware can only be used for stoneware if combined with more refractory clays. As with other kinds of pottery, the happiest solution is the discovery of a single natural clay which combines in itself all the necessary qualities: resistance to heat and atmosphere, plasticity, non-porosity, good colour and texture. Only special localities are likely to yield such a material: it might be looked for in two sources, either among the fireclays which lie between coal seams at Newcastle-on-Tyne, Longport, South Yorks, and the Midlands, or among the stoneware clays of the Poole and Bovey Tracey beds. Our fireclays are nearer than our ordinary clays in character to the clays used in the East. The ball clays and stoneware clays as sold are so unctuous that they must be mixed with coarser material, such as grog, or red clays, or siliceous sand, to give them sufficient character to offset the smooth richness of stoneware glazes. It is generally necessary to mix several ingredients to form a satisfactory body, but this can be done very easily if the right principles are properly grasped. Over-plastic clays may be opened or stiffened with non-plastic clays, non-plastic enriched, and contraction increased, by long, or plastic, clays. Colour and fusibility may be augmented by the addition of red clays, or feldspar may be introduced to increase vitrification. Sometimes it is better to add what are variously called *pitchers* or *sherds* in preference to grog. These are made of the same body as the ware, fired at the same temperature, and crushed to a more or less fine powder.

They have the advantage of both stopping contraction and of opening the body without altering its composition.

Before actual production is attempted many experiments with clay are necessary. It is important, moreover, to ascertain that the source of one's chief material is dependable, for the composition in a clay pit tends to vary from seam to seam. These experiments should be carefully recorded, and raw and fired specimens preserved for future reference. In the actual working of a small pottery these clay tests would probably be combined with slip, pigment, and raw glaze experiments. In Cornwall our local materials consisted of a fusible red secondary clay, china clay, feldspar and sand. For some years we depended upon a mixture of these for our stoneware body. Later we obtained from Poole *Pike Brothers' white siliceous ball clay*, with which we mixed china clay, feldspar and quartz to make a fairly white and plastic, but not very translucent, porcelain. To this we added varying quantities of our local red slipware clay for lighter or darker stoneware bodies. For large pieces we also added our raku clay (p. 56). The only other body made by us was for fine celadons, and there, instead of using red slipware clay, we added 5 to 10 per cent. of raw ochre to the porcelain. This is a rather rough and ready way of doing things but a very convenient one. It would not be expedient if the output were large and close reproduction essential, but with personal control it is possible, and quite usual in workshops in the East, to control by rule of thumb two or three clays, half a dozen slips, and twice as many glazes. It would be pointless to give exact clay compositions because clays vary so much, and unless our clays were used and under precisely the same conditions, the recipes would mean nothing. All that matters is an understanding of the principles involved, and a systematic application of them to whatever raw materials are in any given case available.

Our slipware body becomes dark and very vitreous at about 1150°–1200° C. and would turn to slag at 1300° C. That would be true of most local red clays. But as the china clay easily



34. Northern Sung, Lung Ch'üan Celadon Bowl. The finely cut and combed surface is filled by the thick olive green glaze.

35. Chinese Han Dynasty 'Hill Censer'.

36. Chinese Han Dynasty Vase. Plates 35 and 36 are moulded earthenware covered with a low-temperature green lead glaze showing a silver patina after long burial in tombs. Strongly influenced by early Chinese bronzes.

37. Korean Celadon Bottle. Korai Dynasty; showing the assimilated influence of Persian metal forms by about the 12th century.

stands our highest temperature and remains white, a stoneware body can be obtained from these two materials by adding to the red clay 25 per cent. and upwards of china clay to the point at which plasticity declines, let us say 65 per cent. Pike's siliceous white ball clay also stands up to 1350° C. and emerges from an oxidized atmosphere a light buff colour and from reduction a light grey.

PORCELAIN

True porcelain bodies are made of china clay and feldspar or Cornish stone. But as English china clay is comparatively non-plastic, some ball clay must be added to make the body suitable for throwing. Our St. Ives body is composed of:

Varcoe's No. 1 china clay	45
Varcoe's water-ground feldspar	25
Pike's siliceous ball clay, G.F.S.	16·66
Wenger's 471P water-ground quartz	13·33

Chinese petun'ze, according to James Fairie[1], is not exactly the same substance as china or Cornish stone. But he states that the dykes of petrosilex found, but not worked, in some localities in Ireland correspond to Japanese *amakusa* and Chinese *petun'ze*. Both in China and Japan there are forms of semi-decomposed feldspar which when very well ground make, without the addition of anything, good porcelain bodies which can be thrown upon the wheel.

The fact that true porcelains are not made in England must be largely attributed to the invention of bone china.[2] There is no doubt that if we had wanted porcelain badly enough we could have made it with the materials at our disposal. To-day, with a new conception of fine porcelain opened up to us by early

[1] *Irish Potting Clays, Notes on Pottery Clays,* by James Fairie. F.G.S. Scott Greenwood & Co.

[2] See p.41.

Chinese work, the time seems ripe for fresh experiment. The nearest attempt in the past is the famous *Parian ware* composed of two parts of feldspar to one part of china clay, firing at 1150°–1200° C., but this was chiefly used for unglazed statuettes.

No European porcelain, whether soft or hard, has ever possessed those qualities of body, pigment and glaze which are ordinarily found in the porcelain of the T'ang, Sung or Ming dynasties. In other words, European manufacturers have drawn their inspiration from comparatively debased late Oriental examples simply because porcelain was not made in Europe before the eighteenth century and the finer earlier Chinese wares were practically unknown until the second decade of the twentieth century.

Since nine-tenths of our industrial pots are cast and not thrown, the difficulty of non-plasticity is hardly relevant. But even this difficulty can now be overcome by the use of small quantities of American clays such as *Carolina* and *Florida ball clays*. These have the remarkable property of rendering an otherwise non-plastic body fit to throw with if they are present even in small proportions. Oriental kaolins are much more plastic than any which are found in England, this is due to a higher percentage of plastic mica and, also, to the greater plasticity of the pure clay content, the actual alumino-silicic acid.

Chapter IV

THE MAKING OF CLAY SHAPES

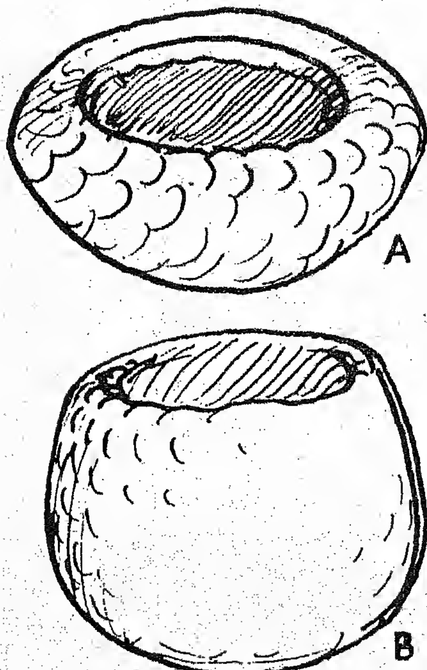
HAND-MODELLED POTTERY

The most instinctive and primitive way of making a pot is by hollowing out a cavity in a small ball of clay with the thumb, and then proceeding to make the wall thinner by squeezing it repeatedly with a regular pressure of the fingers in a slow spiral movement. The result within a few minutes is a thick bowl of about 3 by 3 inches, whereupon a fresh start is made from the centre of the base. This time the repeated squeezings should be closer and more even, in order to make the surface smoother. The thickness of the wall in the lower part at this stage must not be more than is finally required. From now on the bowl should not be allowed to rest on its bottom lest its own weight should cause the soft clay to go out of shape. Holding the pot in the hollow of the left hand at an angle, the squeezing is continued gradually up the wall with a gathering movement of the fingers. With practice, bowls of about the size and shape of a half coconut, but thicker than a coconut shell, can be made in five or ten minutes without any scraping or cutting. If a longer time is taken the clay shows a tendency to dry and split at the lip from the warmth of the hands, and besides, the freshness of quality is soon lost by over-manipulation. This is the method by which most Japanese raku tea-bowls were made.[1]

For different forms and larger sizes the half finished pot is

[1] See Plate 12.

inverted and allowed to harden a little while resting on damp cloths, which keep the rims moist. Then rings or coils of clay are welded on to the inside of the lip with the same kind of movement and pressure. *Scraping*, *smoothing* and *cutting* may also be employed, but mainly for decorative effect. A hand-modelled pot of this kind can be cradled in a shallow bowl, and primitive potters in Nigeria use old broken biscuited sherds as supports. When reversed they are employed as convex moulds upon which clay is pressed out to form the bottoms of coiled vessels. To prevent the soft clay from sticking to them these surfaces should be dusted with dry powdered clay or quartz.



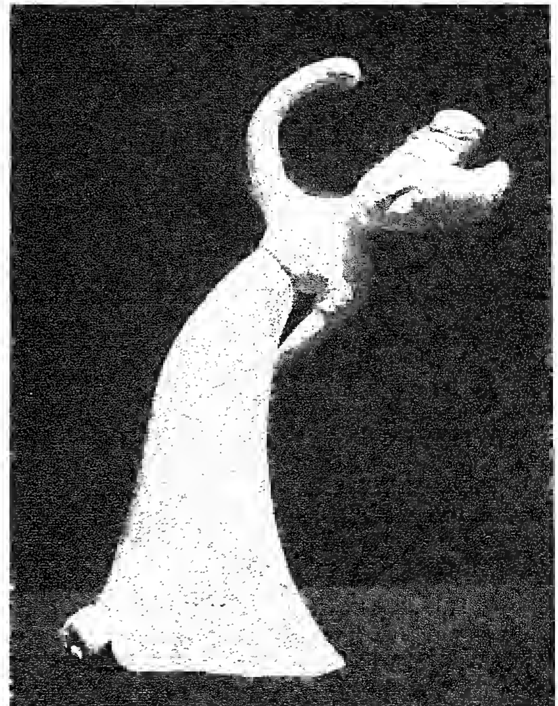
Squeezed or pinched pot

Basket Pots

Baskets were also used by neolithic peoples as moulds into which clay was lightly pressed and smeared. It was necessary for the weave and shape to be such as would allow the clay to come away easily as it dried and contracted. Some pots were even made and baked in baskets which burned away in the fire, leaving the impress of the woven pattern.[1]

[1] The making of basket and coiled pots is described in detail by Henry and Denise Wren in their book on *Handcraft Pottery*.

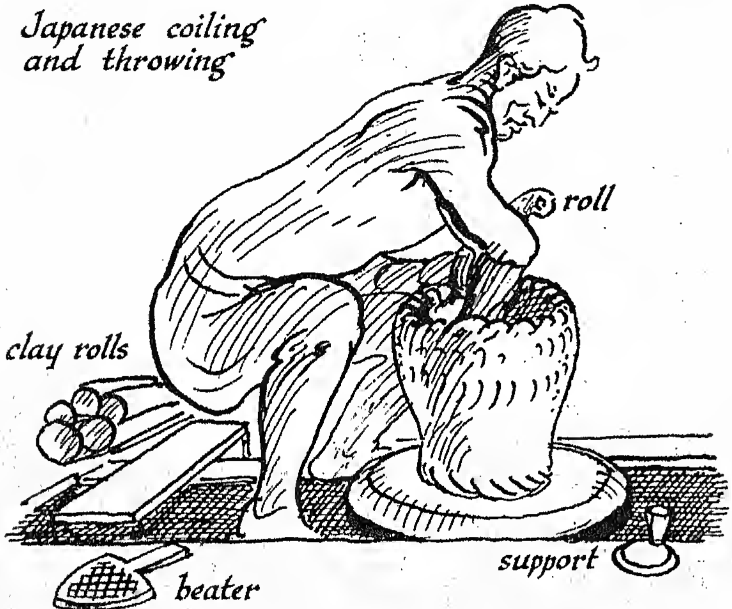
38. Chinese Terra-Cotta Tomb Figurine of a Court Lady. T'ang Dynasty. The beauty of many of these pieces is inseparable from that of the finest sculpture of the period and may be compared favourably with the graciousness of Tanagra.



39 and 40. Chinese Terra Cotta Tomb Figurines; dancers. T'ang Dynasty.

COILED POTS

It seems evident that the making of pots by coiling ropes of clay was derived from basketry, but as a technique imported from another craft, it falls short of methods determined by clay itself. Almost all coiling which I have seen in the East is pre-



liminary either to throwing or to scraping and smoothing. It is simply a convenient means of building up a clay wall for subsequent treatment; the coils are never left as coils. The method is chiefly used to-day for making large pots on the wheel. Three years ago, however, at Tokunabe in Japan I watched one of the last craftsmen able to build up a large pot without using a wheel. The potter walked backwards round a jar, 3 feet high by 3 feet in diameter, with his right forearm loaded with a rope of clay 18 inches long and 2 inches thick, coiling, squeezing, and

smearing it on to the growing wall which was supported on the outer side by the palm of his left hand. The movement was regular and rhythmic, and even before he proceeded to beat the fresh piece of work with a bat, replacing his left hand with a

Coiling and smoothing, Japan

Malayan turn-table

shaped wooden support, the surface was surprisingly smooth and even. Later, when he took wet cloths in each hand and smoothed the six inches which he had added to the height of the pot, it was difficult to believe that the pot had not been thrown on a wheel. Amongst some primitive peoples a crude *revolving base* is used to overcome the necessity for walking round the pot, and it seems evident that this is the origin of the potter's wheel.

THE POTTER'S WHEEL

The wheel upon which a potter moulds his hollow forms is one of the most peculiar and intimate devices which human beings have invented. There is nothing quite like throwing in

any other craft. Wood, metal, fibre and glass are none of them so responsive to the touch as clay.

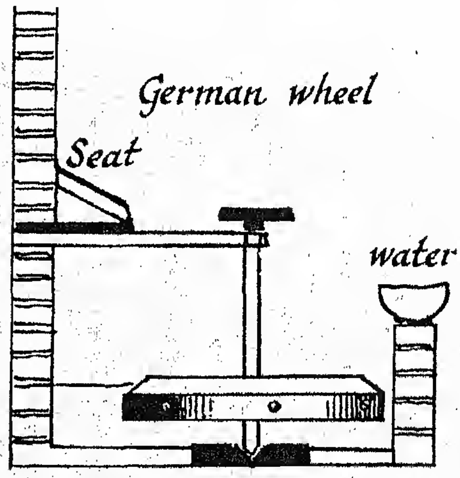
The potter's wheel is known to have existed in Egypt from the commencement of recorded history, and in China and

Indian wheel

Europe it dates back to at least 2000 B.C. The consensus of opinion is that it originated somewhere in the Near East, and that the knowledge of it spread from one centre. The drawings illustrate a few of the many types of potter's wheels. In principle they all consist of a wheel-head, or disk, which revolves with considerable momentum and smooth control of speed and is driven by hand or foot, or by gear. The momentum is obtained from either a heavy wheel-head or from a fly-wheel. In some cases the spindle is attached to the wheel and revolves in

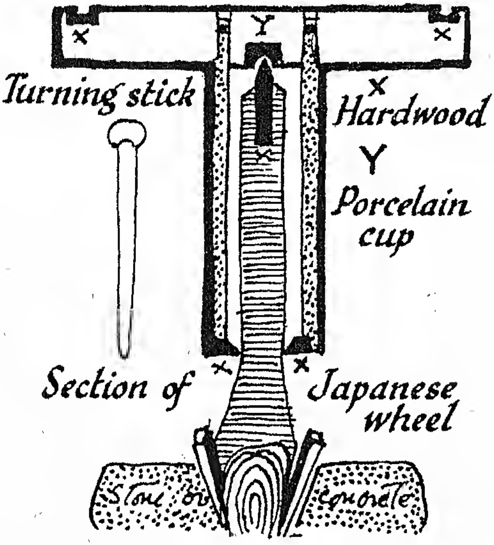
a socket at the base, in others the socket is in the centre of a hollow shaft attached to the under part of the wheel-head and the spindle is fixed in the ground. The latter type is common in the East and the former in the West. The primitive *kick wheel* is turned by the direct action of the bare feet on the fly-wheel, but the more evolved type has a crank in the iron shaft with a kick-bar attachment. Before the coming of mechanical power wheels were also driven by a belt from a large separate wheel hand-turned by an assistant. To-day the action of the best power-wheels is governed by the friction of two cones placed head to tail in such a way that the alteration of the angle of one determines the point of contact and, therefore, the speed of the other.

Kick-wheel, Normandy



The ordinary *hand wheel* of China and Japan has a broad heavy wooden head with four notches near the circumference.

As the momentum slows down, the thrower deftly inserts a short stick into one of these notches and twirls half a dozen times vigorously. The fresh impetus lasts long enough to make a small pot, but has to be renewed constantly for a large one. In spite of this apparently laborious method, the day's output of an Oriental thrower compares favourably with that of our own

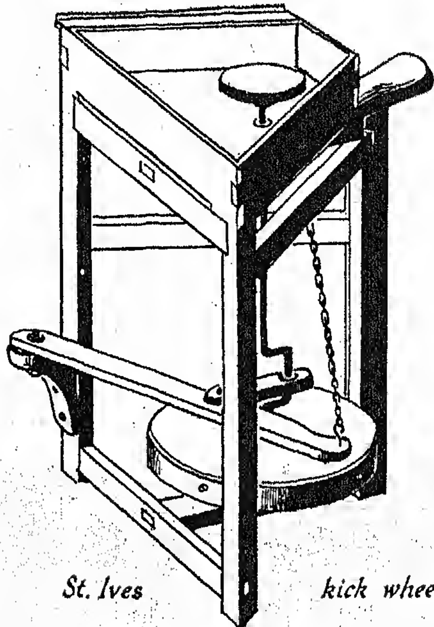


in the West. It is, moreover, a great advantage for the thrower to be able to keep head and body still while making delicate shapes, and especially in turning the bottoms of pots. The most curious of all wheels is that used in Egypt and Syria set at an angle facing the thrower: yet large pots are made on wheels of this type.[1]

A good *power-driven wheel* with easy control of speed and a quiet movement enables a potter to throw large shapes, but for workshop and studio use a well-proportioned and strongly built kick wheel will meet most requirements, and besides is very much cheaper. It is important that the size and weight of the

[1] I have heard recently that similar wheels are also found in the Black Forest.

fly-wheel should be adequate, and that the proportions of the crank and bar should be such as to give an easy long kick to avoid jerking the body. The framework ought to be quite rigid at maximum speed. For these reasons it is unwise to attempt to have a wheel made without plans and specifications. It is best to



St. Ives kick wheel

get a local carpenter and smith to copy an old kick wheel of a type which has proved its worth to generations of potters. There are wheels on the market sometimes successfully foisted upon unfortunate students which are in fact no more than toys. Kick-wheels without seats are also unsatisfactory, but it is surprising how frequently they are to be found in schools of Art. The seat should be about on a level with the wheel-head and close to it in order to give a good purchase.

Throwing

Any verbal description of the manipulation of clay on a potter's wheel is bound to be inadequate, if not misleading.

THROWING

Anyone who watches a pot grow into shape out of a lump of clay for the first time is astonished at the seeming ease with which it happens.

Centring

The clay spins like a top, seeming to prefer the centre of the wheel to any other position, but if the onlooker tries his hand his first discovery is that the clay actually has a preference for any other place than that. So the first thing a beginner has to do, before there can be any question of making shapes at all, is to learn how to centre the clay and keep it centred. Only then is it possible to overcome centrifugal force. It takes a very good thrower to re-centre a pot which has gone even a fraction of an inch out of the true, and the student had much better cut it off and start again.

The clay which is to be used ought to be freshly kneaded, or wedged, before throwing to make sure that it has the same consistency throughout. It is advisable to test masses of clay by cutting them through with a wire to see if there are any hard lumps or air pockets. In England it is the custom after kneading to cut up the clay according to the weight of each pot and the number of pieces of the same shape and size which are to be made in the day's work. These pieces of clay are roughly rolled into balls and put beside the wheel. In very dry weather it is best to cover them with damp cloths.

Throwing hollow ware

A ball of clay is thrown firmly onto the centre of the wheel, care being taken that the wheel-head is damp but not wet. While the pot is being made, the clay and hands should be kept constantly wet. With us it is customary to have the tray or box which surrounds the wheel-head more or less swimming with slip and trimmings, but unnecessary slop is bad craftsmanship and discouraging in a workshop. Now the wheel is turned vigorously anti-clockwise and the wet clay is clasped with both

hands, elbows steadied by the near edge of the box, and pulled towards an unwavering central spin.

The horizontal pressure of the hands causes the ball to rise into a cone, which is then depressed by the palm of the left hand while the right hand continues to pull the clay towards the centre. This up-and-down movement is repeated several times to achieve a final nicety of consistency. On no account should a hollow be opened out and then closed in because softer clay would be imprisoned in the mass and cause trouble later on.

Single-handed throwing

The clay being centred in a comfortable clasp of the right hand, the thumb is pressed firmly down the middle of the dome almost to the wheel-head. Then it is forced slowly outward, forming the bottom of the pot. From this point the action becomes vertical, an even pressure between thumb within and fingers without allows only a certain thickness of clay to pass between them, as the right hand, steadied at the wrist by the left, rises. The fat ring of clay with which the movement started is thus drawn out at each repetition into a thinner and higher wall. This is ridged by the pressure of the fingers, and should always be terminated by a slight thickening at the rim which helps to prevent it from opening out too far. This description applies so far to small cylindrical pots, but if the clay weighs more than one or two pounds the action of a single hand is not sufficiently powerful.

Two-handed throwing

In larger pots the throwing is done by the pressure of one hand against the other. In Europe the fingers of the left hand press outwards and upwards on the inside of the wall of the pot and are supported on the outside by a corresponding urge of the crooked forefinger of the right, or by a wooden rib if a smooth surface is required.[1] The Chinese action is similar to ours

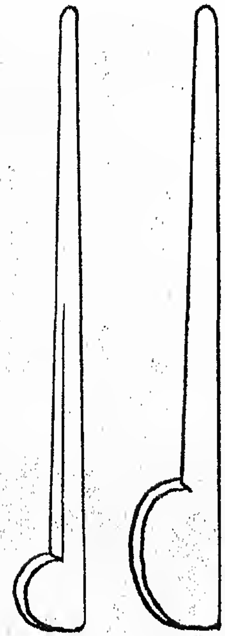
[1] See p. 82.

but the positions are reversed in Japan where the wheel revolves clockwise, reserving the extra strength of the potter's right arm for turning the wheel in the manner which has already been described. Except for shallow bowls and plates the preliminary shape of all upright pots is a cylinder, and that is what a beginner must learn to make. If he is to develop into a competent thrower he ought from the outset to work to weight, measure and time, and not indulge himself too much in efforts to capture beautiful shapes which are beyond his capacity. This applies to art students in particular, who through lack of contact with actual workshop conditions try to make pots as they would paintings and sculpture. On the other hand, throwing easily becomes insensitive and mechanical under factory conditions. Cylinder throwing is frankly an exercise, and a very essential one, but it will soon develop into a progressive exploration of form as soon as the student is able without difficulty to make small cylinders, truly centred, and with walls of equal thickness. Tests should be made from time to time by cutting the pot longitudinally into halves with the wire or needle.

The natural tendency of any open spinning shape is to flare and split at the lip, but this may be countered by *collaring* and gradual closing up with a slow upward and inward clasp of both hands. The lip should then be compressed into a thick ridge. If collaring is done violently the clay will *ripple.* A slight ripple can be smoothed out by support on the inside with one hand while the other gently continues the collaring action. The taller the pot the slower the revolution should be, and the steadier the wheel and its movement. With practice, cylinders eighteen inches high ought to be mastered.[1] Any irregularities on the lip of a pot should be cut off with a *trimming tool*, made by breaking a large needle in half and driving the thick end in a wooden handle. The needle point is pressed gently through the

[1] I have seen pots the full length of a man's arm thrown out of single pieces of good plastic clay.

lip as the pot turns, after which the whole strip will come away with ease. Any lump which comes to light while throwing ought to be dug out at once with a dry blade and the cavity refilled with clay of the same hardness as the body, otherwise a hole will soon be torn in the thinning wall of the pot. The wall ought to be a little thicker near the foot, particularly for high temperatures, as that is the point where the weight will tend to make the pot sag as it vitrifies. This is one reason why stoneware pots are heavy, but it is no reason for making them ponderous.



Wooden profiles used in throwing narrow-necked shapes

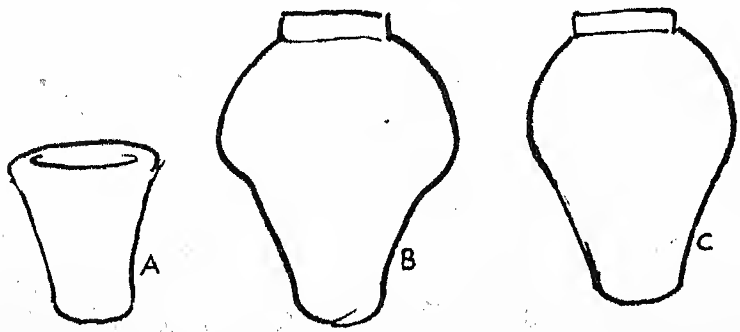
In the East it is customary to work with a large lump of clay on the wheel-head, out of which several pots are made. The potter sits at his throwing tailor-fashion and leans rather more over the wheel than in the West, which is of some advantage in drawing up tall shapes.

The pushing out of a cylinder into curves is very naturally brought about by the persuasive action of the hand inside; but for minor corrections of form in narrow-necked vases or bottles, *long wooden profiles* may replace the hand. These are firmly held at an angle so that the chamfer faces the revolving clay gently distending the curve.

An able thrower takes only a few seconds for centring and cylinder making before swiftly running the clay out towards the final shape. It is this vigour and certainty that give vitality to the rhythms of a pot. Whenever possible, it is best to keep the opening only wide enough for the passage of the hand or arm until the last stages. The longer the action of throwing lasts the wetter, as well as thinner, the wall of the pot becomes, and the

greater the tendency of the clay to 'squat'. Once this has begun it is better to make a fresh start. *The tendency to squat* is much more pronounced in absorbent sandy bodies, and sometimes the only thing to do is to use *slip instead of water* for lubricating the pot while it is being thrown.

The most difficult form to throw is that which has a large belly and a narrow neck. Just where the shoulder begins to turn in and merge its convexity and thrust with the hollow curve of the neck, the clay inclines to sink. For this reason the neck is often thrown separately, and luted and thrown on when both it



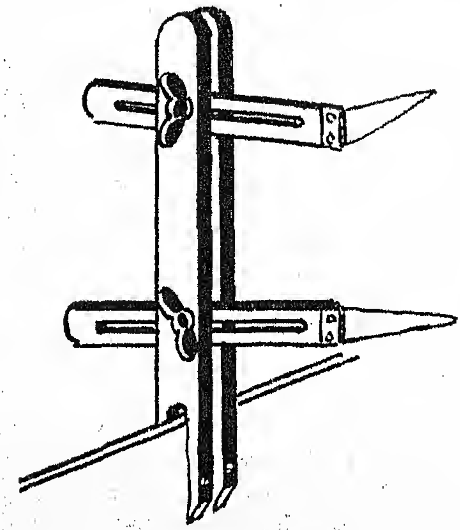
Oriental porcelain thrown in sections

and the body have stiffened a little. In many potteries it has been a common practice to throw large *pots in sections*, and for short bodies, such as porcelain, it is often the only way. At one pottery in Japan I saw two-foot jars similar to the Korean pot in Plate 31 made by throwing bowls half that height and allowing them to become quite hard before they were returned to the wheel, where, by the coiling method, they were extended to the shape shown in Fig. B. The interesting point is that the clay finally contracted without breakage to the shape shown in Fig. C.

Measuring

At the Royal Lancastrian pottery there used to be an expert thrower who could produce in rapid succession different sizes

of tea-pots, with lids which fitted exactly without any other measurement save that of the eye. But, although it is surprising how reliable the unaided eye can become with practice, some sort of gauge is required for repeated identical shapes. The simplest is a long thin tapering stick thrust into a piece of stiff clay and fixed on the further side of the framework of the



Adjustable pot gauge

wheel, with its point adjusted just to touch the lip of the pot, the edge of a bowl, or any other convenient part. A more elaborate system of adjustable hinged pointers is here illustrated; but together with a pair of wooden callipers and a clearly marked foot-rule, preferably with the contraction allowance,[1] this is all that is really necessary.

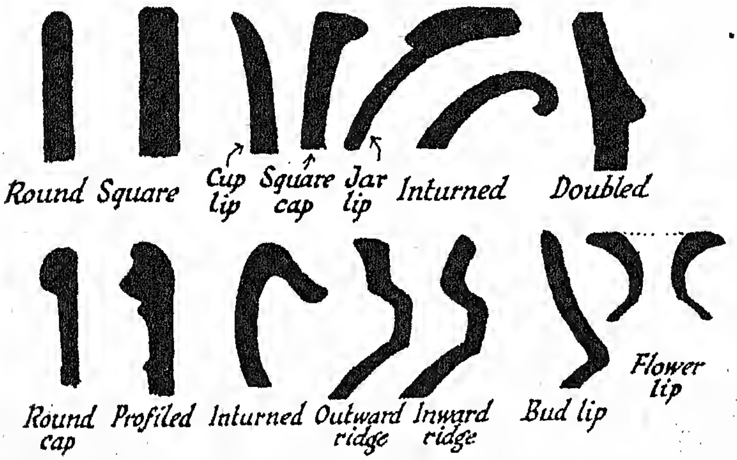
The Lip

The lip marks the end of a series of movements, and requires emphasis both for practical and aesthetic reasons. Indeterminate thin-lipped pots are unsatisfying from every point of

[1] See p. 98.

view. There is an alternative to a thick reserve ridge of clay for making lips, and that is to return the edge upon itself. The accompanying drawings illustrate this, and besides show a variety of mouths suitable for vases, bottles and jars.

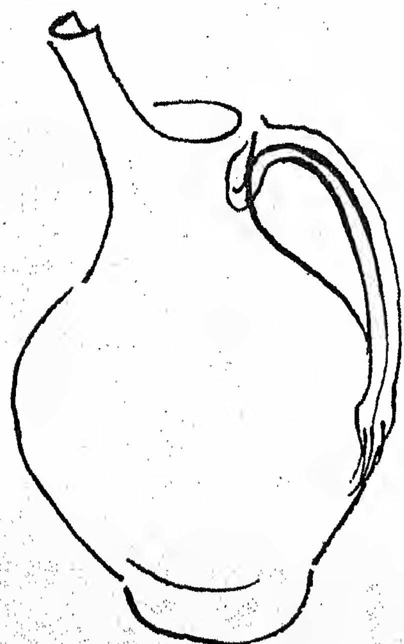
The pouring lip of a jug is made in one of three ways. The commonest, and the one most closely associated with traditional hand work, is formed by pressing out the clay, as thrown, with



Types of pot lips

the wet fingers. The middle finger and thumb of one hand support the mouth of the jug while one finger of the other presses and gently smooths the clay between them, outwards and over. Care must be exercised not to split the clay by a sudden pull. If it does split it can be luted with slip or soft clay after it has hardened a little. A great many old country-made jugs pour badly, and there is no excuse for this annoying defect. The lip ought to be made with a sufficient overhang to prevent dribbles from running down the front of the jug, but this may give it an unpleasant pouting expression. If it is found too difficult to make a good pouring spout in this way, it may be necessary to cut out a V-shaped piece and apply a hand-moulded lip with

slip and modelling tools. The third way of making a pouring lip is by paring the edge of the pot down, as illustrated. The flow of liquid must also be considered and the width of the lip and throat in relation to it. Sharp pointed pouring lips are to be avoided, not only because they are unplastic but also because they are easily chipped. Sometimes it is difficult to reconcile the practical and aesthetic needs of a jug, and the art of jug-making consists in finding a harmonious equilibrium.



Cut lip

Foot and Lip

Some pots can be completed on the wheel at the time they are thrown. With a good long clay the wall can be made thin enough right down to the foot. There it is best to make an *undercut bevel* with a tool. It is advisable to compress the clay of the foot first with the fingers while it turns, as a precaution against splitting. The subsequent tooling may throw up a slight ridge according to the manner of handling the tool, and such an accent will nearly always be found to improve the lines of the profile, corresponding as it does to the emphasis, already referred to, at the lip of most vigorous pot forms.

The cylinder which precedes any expansion is conditioned by the nature of the material and by gravity. The shape which follows is determined by other requirements of use and beauty. In a good pot these elements are welded into a living whole, and

it is illuminating to notice how the inter-play occurs. In spherical shapes there is a structural relationship between the width and weight of the foot-ring below and the lip above, and even in bowls and plates it is always possible to recognize the hard core of structural necessity supporting with its thrust the surfaces of the form.

Bats

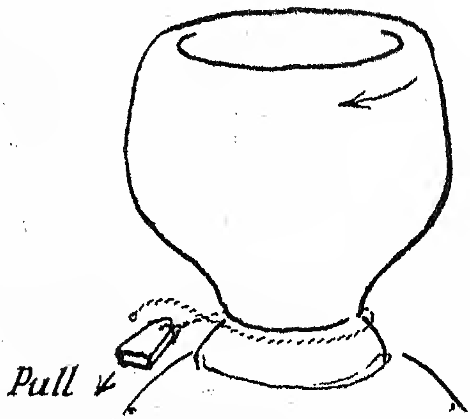
A set of round cleated boards between 6 and 12 inches in diameter upon which large pots, bowls, and plates can be thrown, is very useful. Disks of asbestos can also be used. To attach one to the wheel, a piece of stiffish clay is beaten out on the damp wheel-head to a thickness of about half an inch. The surface is then trimmed with a shaving tool, and the bat, which has been damped on both sides, is centred and then given several sharp blows with a half brick or mallet. This should be enough to hold it in position. A little leverage will remove the bat and the next one can then be damped with a sponge and placed on the same clay foundation.

Cutting off

In England pots are separated from the wheel-head either by cutting with a *thin brass wire*, with a wooden or clay knob at each end, or by a *broad flexible blade* like that of a house-painter's putty knife. By the first method the wire must be pressed firmly along the wheel surface; by the second, the blade should be inserted almost to the centre against the accelerated spin of the clay, and continued with an easy lifting movement, carrying the pot with it supported by the other hand, to its position on a drying board.

In China and Japan the pot is cut off a cone of clay with a *double twisted thread* or gut, usually tied at one end to a small piece of stick. The stick end is held against the foot of the pot while the loose end is carried round by the slow revolution of the wheel three-quarters of a circle, at which point it is pulled through horizontally. The pot, unless it is unusually soft or

wide, is then lifted off, held between the forks of the first and second fingers of each hand, palms upward. Sometimes, for a wider foot, two pieces of pliant bamboo or cane are used to add length to this hold. Japanese connoisseurs pay considerable attention to the thread cut of fine concentric loops, and can often tell when and where a pot has been made by this means.



Japanese twisted thread cut

In special cases it may be worth while to have a piece of hoop-iron made into a ring with a suitable splay to fit the inside of the bottom of such things as pancheons, then the outside may be clasped without fear of distortion. Another method of moving a large soft pot is to wind a few *narrow strips of cotton fabric* around it near the lip or on a dangerous bulge, but the most sensible thing for small scale work is to have a supply of bats of various sizes. It is always advisable to cut through between the base of the pot and the bat as soon as the throwing has been completed, so that the base may contract without cracking.

Base Cracks

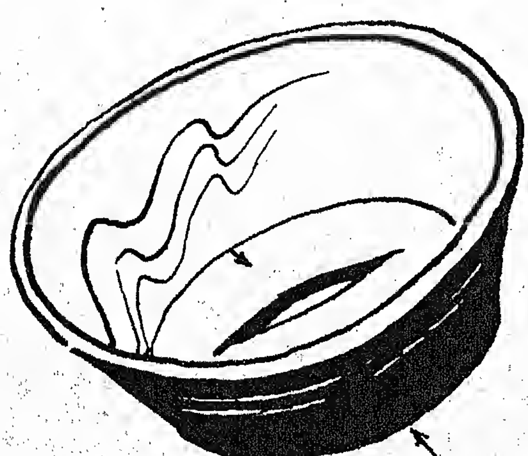
The crack which appears in the unshaved foot of pots made with certain clays can usually be obviated by one or other of the

following methods. (1) After the first opening of the clay on the wheel with the thumb, a small ball or pat of clay can be dropped into the cavity and pressed into the bottom with the next movement. (2) If the pot is to be unturned, the bottom ought not to be more than a quarter-inch thick. (3) If it is to be turned, the thickness should not be more than is necessary, and the turning ought to be done while the clay is comparatively soft. (4) At the end of the throwing, the foot of the pot should be firmly compressed by the forefinger of the left hand aided by the strength of the right hand. (5) The bottom of a pot can be lightly beaten into a concave depression before shaving.

It is useless to try to mend one of these cracks, and actually much of this trouble can be obviated by a clean decisive treatment at the first opening up of the clay and in forming the bottom of the pot.

Oval Dishes or Bowls

Oval shapes can be made with most plastic clays by cutting out of the middle of a dish or bowl a narrow piece of clay the

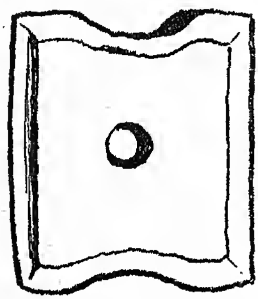


Hand-made oval bowl

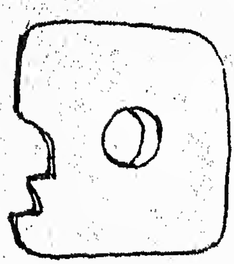
shape of a willow leaf and then pressing the sides firmly together on a sanded board while the pot is still soft. The two raw edges must be forced to meet, the join is then covered with the leaf of clay and smoothed to a flat surface with the firm pressure of a wooden tool.

Large Plates and Bowls

A good way of throwing large open shapes is to place the ball of clay on a bat and beat it with the dry hands, as it revolves, until it is centred. Then, in place of the wet thumb, the hollow is thumped out with the fist in a slow spiral until the flat bottom is surrounded with a



Rib



Profile rib

The leather hold for smoothing lips

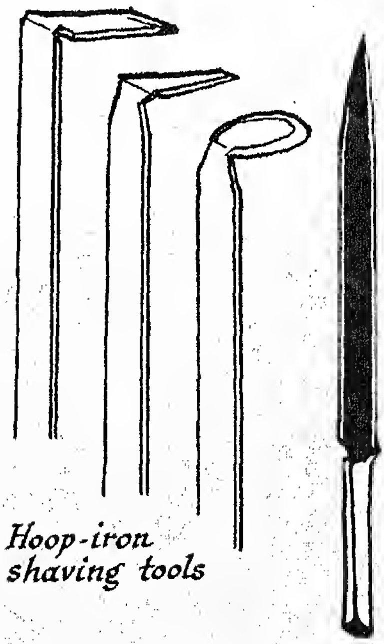
thick coil of clay, which is then wetted and thrown into a vertical wall. This is most easily done with the aid of a wooden profile, or rib, which smooths out dents and ridges better than the hand.[1] From this point the wall is carried out obliquely with

[1] Shaped profiles are also useful in throwing smooth interior curves of bowls.

a slower wheel rotation. The outward spread of the lip needs the compensation of pressure to prevent a split or frayed edge. This can be done by the fingers alone or with wet cloths, or, best of all, with a piece of thick chamois leather held in the manner illustrated. Nearly all Japanese pots are finished on the edges with wet leather[1], which is more suitable for use with clay than are either sponges or cloths. The final turning outward and flattening of the rim of a plate is a delicate operation calling for steadiness of hand and wheel, and good judgment of what the clay will stand without collapsing. Large plates sometimes have to be put aside on their bats to dry a little before the final flattening can be safely done.

Turning

The foot and the thick lower part of the walls of many pots need to be shaved down when the clay has become leather-hard. In factories this is done on a horizontal lathe, but in the East pots are placed bottom-up on the wheel and turned in a vertical position. They are centred by three or four sharp light taps with the side of the hand as the eccentric revolutions bring the pot towards it. The pot is then fixed in position with a roll of slightly stiffened clay. For smaller and for narrow necked pots a *chuck*, or raw clay cylinder, is used as a holder or support. A



Hoop-iron shaving tools

[1] Deerskin or chamois.

Japanese thrower makes these rings, or chucks, of the same clay as the pots, and of the sizes and shapes required, to be put aside to harden with the pots.

Shaving tools are made out of rather thick pieces of hoop-iron bent at the ends and filed into various angles and curves, as illustrated. As they quickly get blunt the cutting edges should be filed on the backs to a chisel section; otherwise they not only fail to cut but also tend to *chatter*.

When the reversed pot is centred for turning the right width for the foot is determined by eye or callipers, and a firm vertical cut is made, of about the depth of the foot-ring, with a rectangular tool. This is followed by a series of spiral shaves down the wall of the pot until a good profile is obtained, unless, as sometimes happens, the thickness of the pot has been misjudged, and the blade suddenly rips through the wall. It may be anticipated, however, by occasionally *tapping the clay* and judging the thickness by the sound. Another vertical cut is made for the inside of the foot-ring, with an allowance for further correction. Then follows the hollowing out of the foot with a tool of appropriate angle or curve, from the centre to the inside cut. The number of operations will depend upon the depth of the foot-ring and the hardness or softness of the clay. Finally, the bevels on the foot-ring are chamfered off. Quite different textures and effects are produced by the degree of hardness of the clay. If it is too soft it will clog the cutting, if it is too hard the work will be laborious and the result unplastic. In general, the quickest work and the most plastic expression is obtained by using sharp tools freely on fairly soft sandy clay. For rough clays containing particles of grog, it is sometimes preferable to polish the surface after turning, in which case the back of the shaving tool can be used as a burnisher.

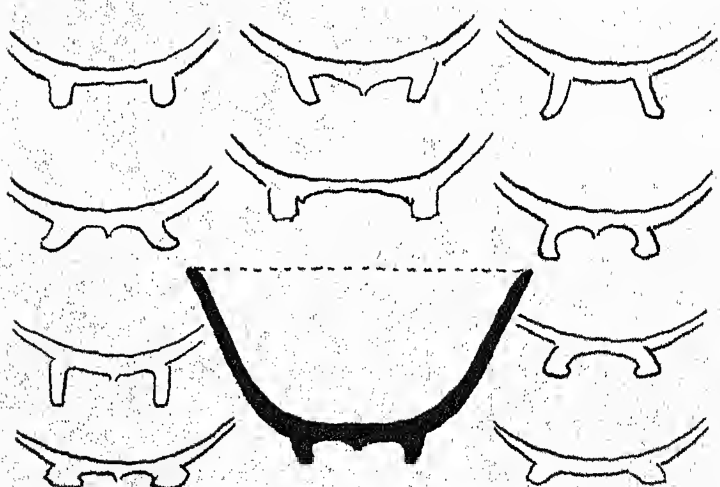
The difference between the soft finger ridges of throwing and the sharp cutting of the metal tools is equivalent to that between modelling and carving, and when one shaves pots in this Oriental way good taste is called for in making the transition

from one kind of surface to the other. The fine grained non-plastic pastes used for porcelain generally necessitate an exceptional amount of turning, and this explains the comparatively cool hard outlines even of Oriental porcelain, and the consequent desire to enliven these surfaces with painted decoration. In the West turning is relatively a mechanical technique, and it would not be an exaggeration to say that our industrial conception of the surface and finish of pots has been mainly influenced by the techniques of exact turnery and casting. The resulting precision is a necessary corollary of mass-production, but it need not blind us to the greater freedom attainable by the use of simpler tools adapted to the hand. It is as unreasonable to apply the standards of power technique to hand work as it is to insist that the machine should imitate the expressive irregularity of hand-made articles. Therefore, the turned surfaces of hand-made pots may not unreasonably be expected to show the characteristic marks of hand and tool, provided they are free from affectation and improve the texture and form. Many irregularities in the feet of Chinese and Korean pots strike the European eye as pure clumsiness, or, in Japanese Tea Ceremony wares, as deliberate distortions, grains of sand adhering to the feet of Ming porcelains, quartz spur marks embedded in Korai celadons, imperfectly centred turning of later Korean pots, notches cut out of the foot-ring[1], or rough unglazed areas, which scratch silver and polished tables; in general, a series of imperfections from a utilitarian point of view. That they were not drawbacks to the Orientals who made them is due to their manner of life, their use of wooden chopsticks, for example, instead of table silver, and also to the fact that most of the wares in question, whether glazed or not, are impervious to liquids. But, underlying these apparent crudities, there exists in the East a perception of beauty to which a growing number of

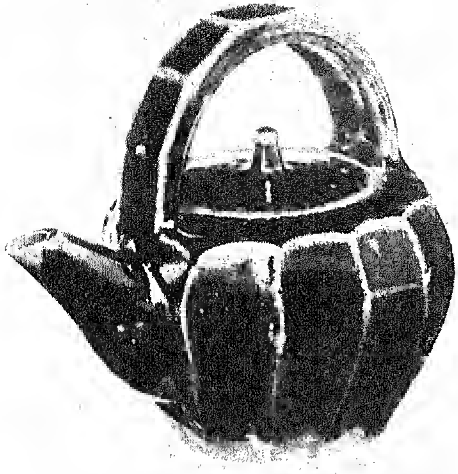
[1] Some Korean rice bowls, made either in Korea or by Koreans in Japan, were notched in the foot-ring to hold a cord when they were packed for transport. Later on they were adopted by Japanese tea-masters for ceremonial tea, and then copied by Japanese potters.

people in the West have become susceptible during the last thirty or forty years. Some of these seeming imperfections are inseparably bound up with the conception and execution of hand-made pots at the given time and place of manufacture. Even if the Japanese sometimes made a fetish of them, it was due to over-emphasis of taste and not to clumsiness. The Oriental potter made a virtue of necessity, but it would be an affectation for us to copy him blindly. Need and method have changed; but the virtue remains as a stimulus and a source of delight. Provided a good tradition is kept alive amongst a group of potters, making hand-made pots quickly and economically, something of the precision and breadth of old Chinese and Korean turning will be achieved. The briefest movements of the best available tools are discovered for each job by a process of natural comparison and elimination, and they become part of the ritual of a tradition which leaves no time for self-conscious hesitation.

The variety of types of unglazed foot-rings of Oriental pots is rich in comparison with ours. The series illustrated is by no



Types of cut feet



41. Porcelain Teapot by Shoji Hamada. Thrown and cut shape, including the handle. Black 'tenmoku' glaze breaking to rust.

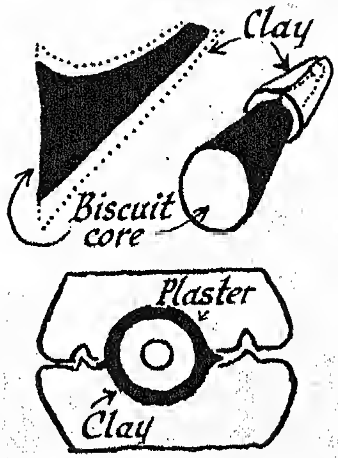
42. Stoneware Teapot by the author. Engraved pattern showing through an olive blue glaze.

43. Present-day Cornish Slipware Pitcher. Sound form and good craftsmanship unchanged since the 18th century.
44. Chinese Stoneware Chün Bowl, Yüan Dynasty. Heavy lavender coloured glaze with copper markings in grape purple (in the collection of Henry Bergen) (see page 240).

means exhaustive, but may serve, together with the corresponding set of sections of lips, as suggestions based on good models. It will be noted that the inside of the foot is a continuation of the main lines of the pot, and that a satisfactory termination of the form at this point is of great importance.

Spouts

A teapot is about the most difficult article a potter is called upon to make. In comparison with a vase of equal size it requires in addition, a lid, a handle, a spout, and perforations to retain the tea leaves. Each one of these parts may take as long to make as the pot itself, and to assemble them successfully requires considerable foresight. To gauge the size of a spout, to cut and mould it to a teapot so that it will both pour well and balance the handle satisfactorily, requires much practice and a good sense of form. Since the fired teapot must also match the rest of the set in colour as well as shape, it will be readily understood that tea-sets involve the studio potter in troublesome and unremunerative work. Spouts can be made in two-piece moulds, or over a plaster or biscuit core, or they may be thrown on the wheel. When spouts are thrown, a straight edge such as a penny ruler, the edge firmly held against the inside of the spinning clay cylinder, is of great help in elongating the thin wall. A spout which pours without dribbling should be the potter's aim, but there is no golden rule for making one. The turn over, which I recommend for jugs, is usually very ugly in teapots. The thin lip of a metal spout which cuts the flow of liquid

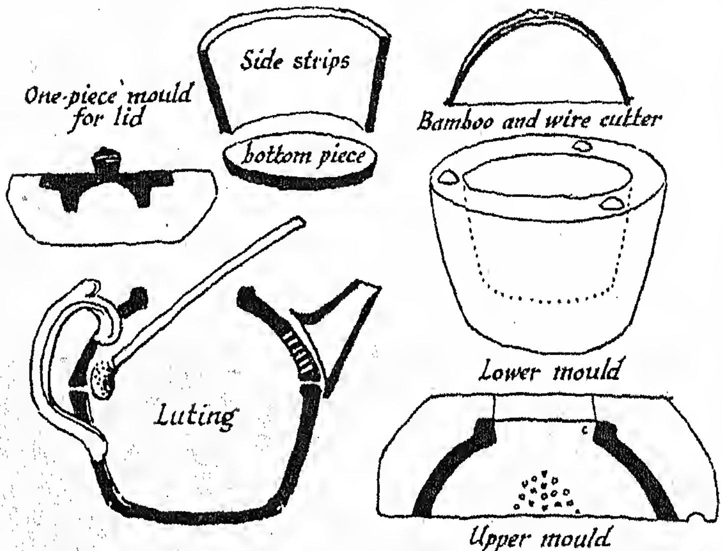


Spout moulds

would be too fragile if imitated in clay. The three following points may help towards a solution of this difficult problem: (1) the holes at the base of the spout must not be too small or too few; (2) the spout should taper; (3) the final pouring edge should be fairly sharp.

Handles

Handles are moulded and attached at the leather-hard stage of drying, except in the case of porcelain, in which the joining



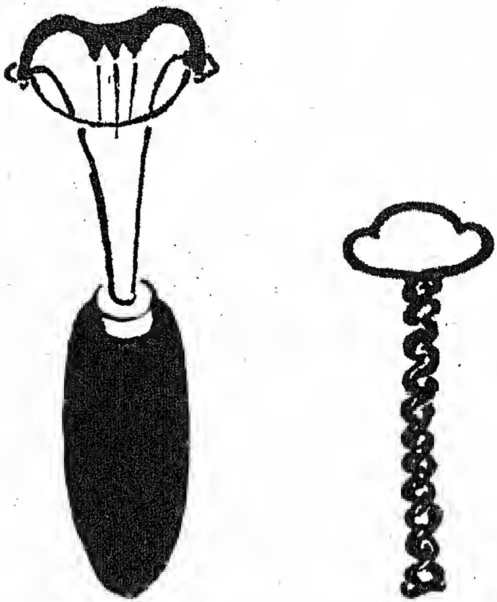
Moulded tea-pot

is usually done with a touch of slip when both handle and pot are bone dry. But *the pulled handle* is the most suitable for the craftsman and studio potter (See Plates 22, 23, 24, 43).

A 2 or 3 lb. cone of clay, somewhat harder than is used for throwing, is taken in the left hand and gradually coaxed with the full grasp of a wet right hand into a long smooth tongue. When it is judged that the thickness, section, and ribbing are suitable for the pot, a sufficient length is nipped off by the thumb against the forefinger, and the butt end is rammed

against the pot where the handle is to begin. It is advisable to score the surface of the pot with a tool, and to support the inside of the wall with the left hand during the operation. On no account must the surface be wet, but the pot ought to be as soft as possible in order to equalize the contractions. After the butt end of the handle has been welded on by the thumb above and the forefinger below, the tongue of clay is bent into a loop which will give a comfortable grip for as many fingers as the size of the pot warrants, and the end is pressed home and any residue either used decoratively or swept aside. The butt end ought to be attached to the pot much as a branch of a tree grows from the trunk, and an oval section for the handle is more graceful, comfortable and strong than a round one. The loop should project only far enough to allow room for the fingers, and, with few exceptions, the handle should bridge that part of the pot which is concave (e.g. the neck of a jug), thus avoiding unnecessary projection. In some potteries where the body used is very plastic, the pulling of the handle is done on the pot itself as soon as the end is firmly attached; but if the body is short, it is not easy to pull it out rapidly without snapping it. With short clay it is better to use slip instead of water as in throwing. Various ridges and cross-sections are dependent on the position of the hand in grasping the clay. Cones of throwing clay are put aside to harden with the pots that have just been made on the wheel. If the pot is too hard, or the cone of clay too soft, the handles will detach themselves or crack during drying.

Certain kinds of handles require a firmer attachment at the lower end. In such cases, additional pieces of clay can easily be welded in with the wet fingers. Another method of making handles, which came into use at the beginning of industrialization, was *the wire-cut handle*. By dragging a wire loop through soft clay, uniform strips are quickly made which can be bent to any requisite curve, allowed to harden a little, and then attached to the pot in much the same way as ordinary pulled handles. It

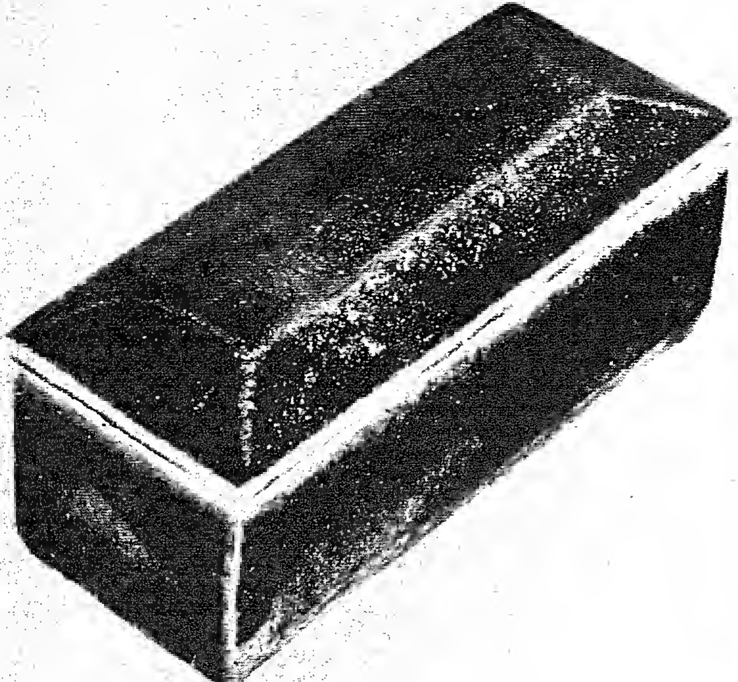


Handle cutters

cannot be too strongly emphasized that the merit of a handle, foot, lip, spout, or knob can only be finally appraised as a part of the whole pot.

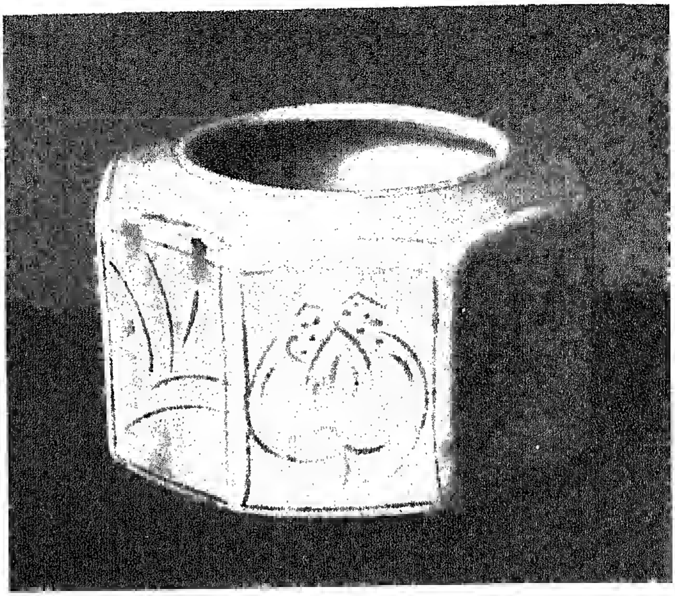
Perforations

The simplest way for the hand worker to perforate the front of a teapot is to bore a series of holes with *a short length of umbrella spoke* which has been filed to a tapering point, and then to plane or shave that part of the wall to a thickness of about one-sixteenth of an inch. The hollow groove in the umbrella spoke removes most of the clay, and the remainder can be brushed off the inside of the pot when it is dry. In Staffordshire potters' borers are made of brass, and shaped like a small gouge. A similar tool can be made very quickly out of bamboo.



45. Tenmoku Stoneware Box, black breaking to red rust, by Kanjiro Kawai of Kyoto. Individual Japanese potter (see page 96).

46. Persian Lustre Bowl, Rhages, 10th cent. It is rare to find the human figure successfully employed as a decoration on pots. The spacing in this precursor of heraldic pattern is vivid (see page 119).

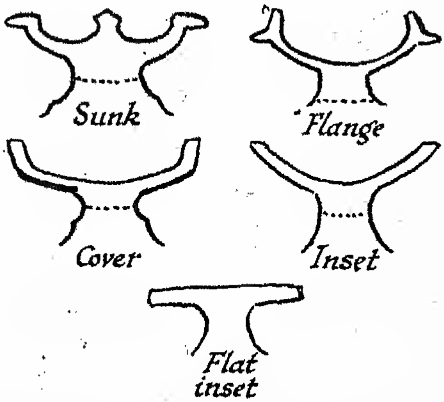


47. Inlaid Porcelain Jar with cut sides by K. Tomimoto. First individual Japanese potter.

48. Cut and planed Stoneware Bowl by the author. Warm grey and rust glaze.

Lids

The five drawings on this page show different methods by which thrown lids can be made. All of these, except the first, which is thrown and finished in one operation, are thrown upside down with thick bases, to be turned later, for knobs when required can either be turned or added later by throwing.



Thrown lids

The snug fit of lids is a matter which deserves special attention, for it gives a particular satisfaction to the user and is an evidence of competent workmanship. The diameter should be measured by callipers while throwing, and a slight margin may be allowed for later turning. This is advisable because of the tendency of some shapes made of very plastic clays to contract more than others. Whenever possible, it is also a good plan to shave the lid in its proper position on the pot so as to make sure of a good continuity of line. In addition to true fit, teapot lids should be so shaped that they will not fall off when the pot is tilted. To make certain of this, they must either have heavy *flanges* or be set in deep sockets. The forming of these flanges, or in the case of the pot itself the gallery or socket for the lid, is most easily done at an early stage in the throwing whilst the clay is thick and firm leaving only the finishing with a leather to the end.

Knobs and Feet

There are several ways of making knobs and feet besides free modelling or press moulding or the turning described above. Loops of various shapes can be attached to lids in the same way as handles are put on jugs. Balls of clay may be attached with a little slip and either thrown into shape or moulded by a repeated twist of wet forefinger and thumb. This is also a quick and effective way of putting feet on round bottomed pots. In the case of turned porcelain with its harder forms, carving may be employed in addition to modelling for spouts, knobs and feet. This is very simply done by allowing the roughly modelled clay to harden sufficiently for cutting.

A convenient tool for cutting the soft-turned foot of a bowl into three or more segments is a metal ring, wider than the bottom of the pot, to which is attached the requisite number of fine brass wires. These are gathered together and twisted in the centre, forming equidistant radii. The pot is reversed and fixed, the ring is taken in two hands and pressed down around it, causing all the wires to cut the foot ring simultaneously with whatever movement is imparted to the implement.

Damping and drying

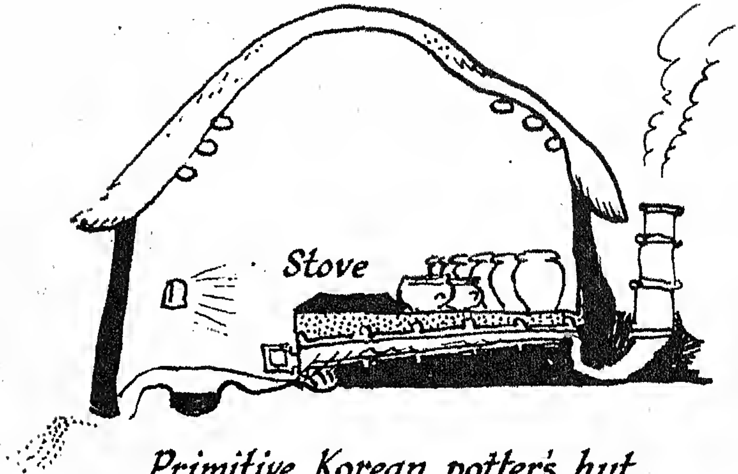
A box, or, preferably, an air-tight cupboard, wide enough to take standard pot-boards on ledges, is indispensable in any workshop for preventing half finished pots from drying too quickly. A three-inch layer of plaster of Paris at the bottom, or loose plaster slabs, upon which water is occasionally poured, will keep the atmosphere humid. In addition, pots which from one cause or another have got too dry can be covered with damp cloths and softened. Some clays will stand wetting even after they have changed colour on the edges, but this can only be determined by experience, and in any case, care should be taken that water does not run down the sides of pots and make puddles, which quickly disintegrate the clay.

Drying is best done naturally. In the East out-of-door trestles are a permanent feature of country potteries, and they may often be seen loaded with boards of pots drying in sun and wind, with a man going the rounds carefully reversing or turning the pots. If a sudden shower threatens, a cry is raised, and all hands come running out, and in a few moments the boards are taken under cover. While the clay is still pliant there is no danger from warping, and, in any case, pots are automatically trued in the process of turning on a flat wheel-head provided they have not become too hard.

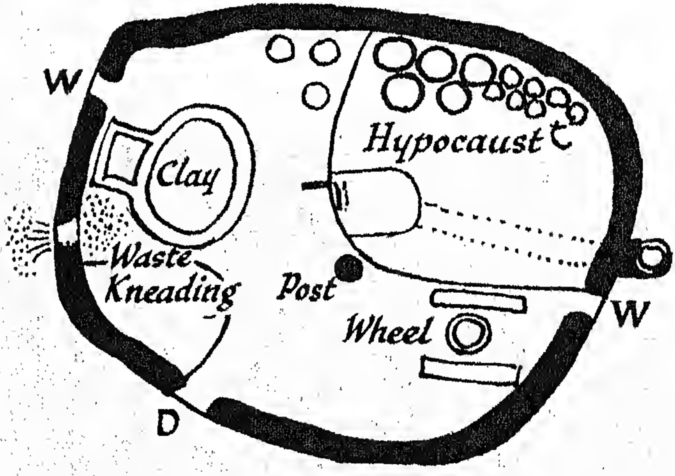
In Korea, where the winters are exceedingly cold and dry, work continues in round thatched huts, and drying is done, as the drawing shows, on a gently heated platform. This simple adaptation of the Roman hypocaust has the advantage of drying the thick foot of the pot first. With our damp and variable climate a *drying cupboard* or room with gentle artificial heat and ventilation is a necessity. At St. Ives we utilize the low gable of an attic for this purpose.

Moulds

Plaster of Paris is to the factory what the wheel used to be to the potter's workshop. By far the largest proportion of modern pots are made by the use of plaster moulds, whereas in pre-industrial times *biscuited clay moulds* were employed on a small scale, and it was the wheel which supplied the world with most of its pots. The transition from biscuit to plaster concerns us here, and the relative value of each to the studio or workshop potter. There is no question as to the convenience of this cheap, quick-setting, absorbent substance—plaster—in mould-making. Without it, casting, the most important process in mass-production, would be impossible. But it is debatable whether, from the point of view of beauty, plaster is to be welcomed, not so much because of any inherent evil in the material, as of the fatal facility with which it has been used to multiply florid



Primitive Korean potter's hut



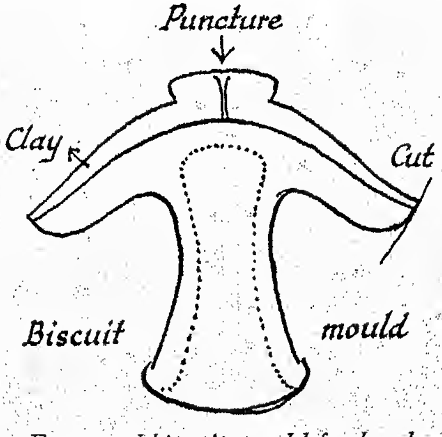
forms.[1] To the studio potter plaster is of far less import, unless he happens to be a figure modeller, and even in this connection

[1] Because of prevalent banality of taste it is easy to overlook the vast distribution by this means of plain and practical domestic crockery and sanitary ware, which, although seldom beautiful, has nevertheless brought a large measure of physical refinement to millions of homes.

it is worth recording that no pottery figures have equalled the T'ang tomb figurines in beauty of plastic expression and they were mostly duplicated from two-piece biscuit moulds.

Beyond the characteristics mentioned above, plaster has very little life of its own. It possesses no variability which the artist in the craftsman can take advantage of, and for that reason it is more suitable for large scale reproductive work. For this reason, and because several of the books on pottery mentioned deal fully and clearly with its use, a description is omitted here.

For simple work two advantages of biscuit for press moulds are, first, its comparative durability in yielding sharp impressions; secondly, the continued use of the potter's familiar material, clay. This enables him to engrave or emboss the mould itself in a half dry state with greater freedom than is possible on plaster. Thus many Sung and Korai bowls were made by pressing and beating the outside of thrown shapes, usually bowls, on to engraved convex moulds, and shaving the backs in the usual way. The Chinese up to the present day use biscuit moulds very ingeniously for round and angular wares, freely combining, within the limits of the material, moulding, modelling, throwing, and turning. As with plaster, biscuit moulds must be thoroughly dry before they are used, but, in addition, they should be dusted with powdered silica, or clay, or wood ashes to counteract sticking. Even with this precaution, a soft proof frequently needs assistance in shrinking from the biscuit mould by the gentle pull of an extra squeeze of clay



Engraved biscuit mould for bowls

which has been pressed against it, or by jarring the mould, or, finally, by blowing between mould and proof. *Shallow moulded dishes or bowls* can be made by pressing slices of clay, cut in the manner already described, into concave, or onto convex, moulds. The shape should permit a moderately soft sheet of clay about a quarter of an inch thick to be stretched by the pressure of the palms of the hands to its curvature without splitting or folding. The mould may be engraved or embossed, but in any case it should be dusted before each impression is taken. The clay should be hard enough to allow the pot to be reversed on to a board at once.

The clay of which these biscuit moulds are made should be open, and the firing ought not to be so hard as to diminish porosity. The green-hard matrix is oiled before the negative moulds are taken from it. The latter usually have to be corrected as they tend to be distorted in the process. In some cases no matrix is employed but, instead, the mould itself is thrown or modelled direct.

Slab-built shapes

Another method of making angular pots which, together with pinching and coiling, is especially suitable for use in schools, consists in preparing slices of clay of suitable thickness, half drying them, cutting each facet with the aid of a template, and luting the pieces together with slip. This is a kind of ceramic joinery, and, provided the designs derive from the nature of the material, it offers yet another wide range of expression to the studio potter (See Plate 45).

Slice cutting

The simplest way to cut slices is to use a pair of vertical bars of hard close grained wood marked off on one side into one-eighth of an inch, and, on the other, to quarter-inch spaces by horizontal saw cuts. A thin brass wire with tags at each end is stretched from bar to bar and held in corresponding slots by the grip of each hand, and the taut wire is then pushed through the

mass of clay with the ends of the two bars kept firmly down on the table-top or board. The bulk of the clay can then be moved to a fresh position, leaving single slices to dry, or the wire may be moved up one space after each cut, in this way making a pile of slices which will remain damp for a considerable time. Slices so cut are usually scored by the track of some coarse grain of sand or grog dragged through the mass by the wire. It is very easy to smooth the surfaces with the flat of a large blade, such as a carving knife, or with the edge of a wooden board. This also helps to compress the clay, but it often happens that the granulated slice, as cut, makes a preferable surface texture for the pot. The best way to cut the slices up into pieces of accurate size and shape is to make templates of paper, card-board, linoleum or wood, and lay them on the clay and cut round them in outline. These pieces must be kept very carefully at a uniform degree of green hardness. The surfaces which are to be joined are first scored, and then basted with thick slip. The pieces are then firmly pressed into position. Thin strips of soft clay are next pressed into the interior angles and pressed smooth with a sponge or piece of leather. Finally, the *clay plane*[1] is used for trimming and chamfering external edges and angles.

Tiles

Tiles thin and even enough to satisfy the requirements of mason and architect are not easy to make by hand. Ordinary commercial tiles are usually made of very uninteresting clay, but fireclay tiles of good texture can be obtained from the Stourbridge firms at a low cost. The main difficulty in tile-making by *the wet process* is to avoid warping. The industrial method is to stamp tiles out of *damp clay powder* under heavy pressure. The apparatus is expensive, and the monotonous work unsuitable for the small scale potter. The following

[1] See p. 111.

simple methods can be recommended for school use and for experimental production. They also come in very useful in making bats and kiln shelves.

The clay can either be compressed into a wooden or plaster mould for each separate tile, or a larger rectangular slice of clay, made on the same principle, may be subdivided by cutting. The first method is simpler for very small quantities, but the latter is probably the best for studio and school use. With slight variations it is that described by C. F. Binns in *The Potter's Craft*, New York, 1922. A tray is made by attaching to the four sides of a perfectly level and rectangular board strips of wood which rise above its surface the exact height of the damp tile. They are marked at intervals with slight notches corresponding to the size of the raw tile. Presuming that twelve 4 by 4 inch tiles, of an approximate thickness of half an inch are to be made at once, and that an allowance of 10 per cent. for total contraction of the clay during drying and firing is sufficient, then the board would need to be $13\frac{1}{5}$ by $17\frac{3}{5}$ inches in size, and the ledges $\frac{11}{20}$ of an inch high.[1]

The tray is dampened and evenly dusted with a coating of fine grog, quartz or sand, and then a ball of clay is rolled out with a rolling pin to fill the framework completely, and any excess of clay is struck off cleanly with a straight-edge from the centre outwards. At this stage various textures can be imparted to what will be the face of the tiles by brushing, combing, slipping, dusting with grog or sand, or smoothing with a long flexible blade. The whole rectangle of clay can then be cut into four squares by three squares each measuring $4\frac{1}{5}$ by $4\frac{1}{5}$ inches. The cutting should be done with a thin firm blade held vertically against the side of a ruler, but the point of the knife should not penetrate quite as deep as the wooden board. The reason for this is that a slight attachment of tile to tile will pre-

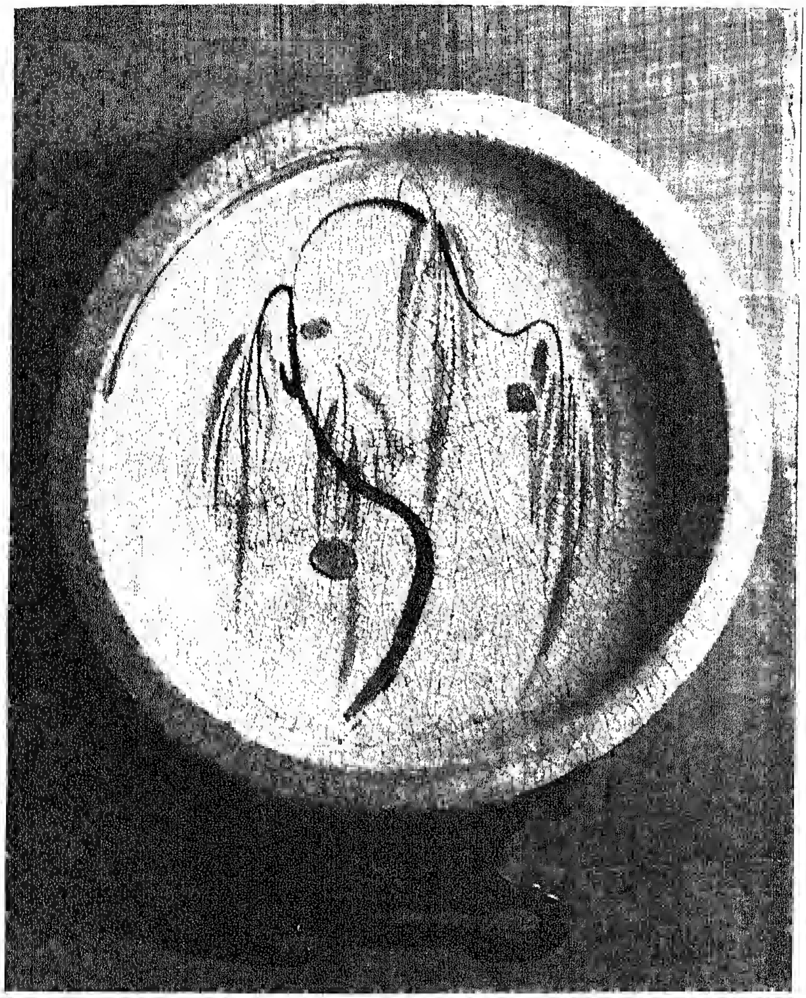
[1] To save constant calculations it is convenient to make a special ruler for each clay with a different rate of contraction. The marks on it should represent actual inches and fractions plus the contraction.

vent warping. It is best to dry the tiles slowly, in their mould, at an angle of 45 degrees until the clay reaches the consistency of stiff leather. At that point the whole sheet may be reversed on to another board and gently broken up into its component sections each of which should be trimmed with the clay plane. If warping still persists, powdered quartz or flint should be added to the clay mixture, or if a less porous tile is required feldspar, or Cornish stone, may be used instead. The backs of the tiles can either be stamped with seals to form a key, or square headed hob nails (which would automatically leave their impress on the backs of the tiles) may be driven into the face of the tray at proper intervals. By using a sharply incised plaster bat, instead of wood, to form the bottom of the tray raised patterns may be imprinted on the clay. Tiles with stamped patterns of this kind are best made singly. Clays used for tile-making must be refractory. Fireclay reinforced by at least one-third of its own weight of fine to medium grog—raku clay, in fact—is suitable for high temperatures. At lower temperatures proportionately less heat-resistant clays may be used if they are stiffened with sand or grog. Textures will be largely determined by the screen through which the grog or sand has been passed. Between 20- and 40-mesh is most suitable. Colour can be deepened by the addition of red clay, or slips can be applied to the tiles either before or after biscuiting. The thinner the tile the greater its inclination to warp, on the other hand tiles which are much more than $\frac{5}{8}$ of an inch thick are heavy for transport. In stoneware firing we have found half an inch sufficient for tiles up to five inches even when they are packed back to back and on edge.

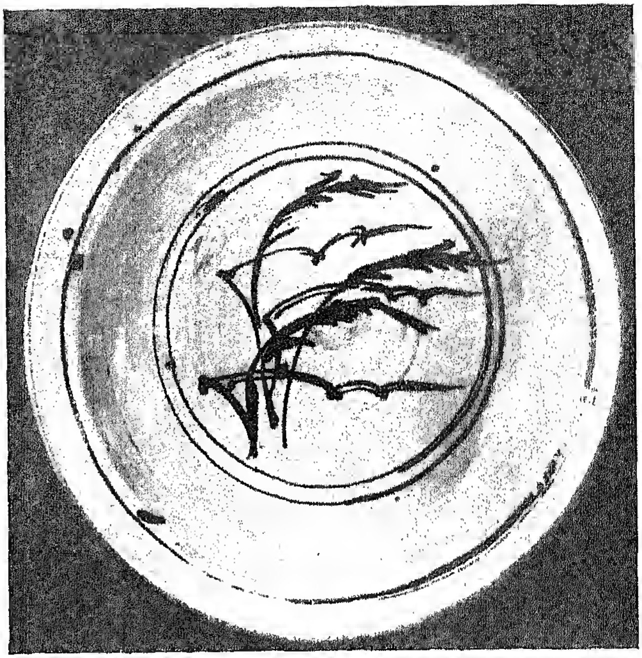
The drying of tiles needs to be carefully watched. No strong heat should be employed, and draughts ought to be avoided, so as to give the clay every chance to contract slowly and equally. The tiles ought to be reversed on their flat boards several times during the process.

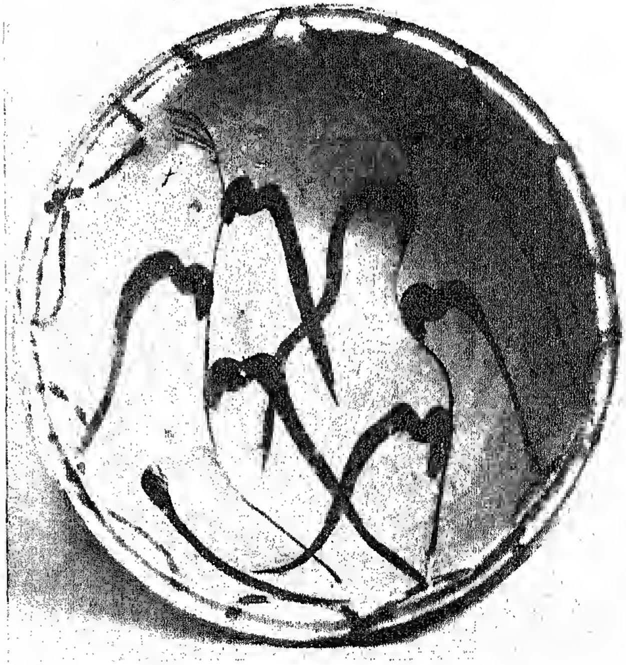
Seals

A note may be added here on what is often the last treatment of the clay before it is allowed to dry, namely, the marking of the pots with the name or sign of the designer or pottery. This is sometimes done by scratching on the bottom of the ware in ordinary hand-writing. This is unpleasant to anyone familiar with the discreet treatment of the exposed clay foot of Oriental pots. The alternatives are to stamp the bottoms with a small seal made of biscuited clay or of wood, or to paint a signature in underglaze colour. Many of the old painted signs had a delightful decorative and calligraphic quality which is lacking in our own day. If any mark is to be used to indicate the potter's identity, for those who are unable to recognize him by his style, a simple well cut seal yields an impression which suits bare clay and adds to the finesse of this hidden but important part of a pot (See p. 226).



49. Japanese Stoneware Dish made at Seto (in the possession of the author.) The lovely willow pattern in brown and blue was probably painted by a child as was the custom in the 18th and 19th centuries. The blemishes are due to the method of packing described.





50. Stoneware Bowl by Kenkichi Tomimoto. First individual Japanese potter.

51. Japanese Stoneware Dish made at Seto, 18th or 19th century. The loose peasant pattern may be contrasted with the nervous energy and individuality of Tomimoto's brushwork.

Chapter V

DECORATION

The word 'pattern' really means original motif in the sense of exemplar, and not its repetition, or copy, but we have come to use the word loosely for applied design in general.

Patterns may be described as concepts of decoration reduced to their utmost simplicity and significance. They are analogous to melodies in music and proverbs in literature. Their significance is enhanced by directness of personal statement and detracted from by mechanical reproduction, for in such reproductions continuous vital interpretation is lacking, however good the original. That is why well painted pots have a beauty of expression greater than pottery decorated with engraved transfers, stencils, or rubber stamps.

Hand-made pottery

Hand-made pottery—Chinese of Han or T'ang times, Mexican or Medieval English—decorated by various stamping processes, may surpass painted pottery of good periods in formal beauty. But such reproduction is conceived in the simplest terms of material and technique, and is carried out by hand with an allowance for irregularity which is human and not mechanical. A pattern may be symmetric or asymmetric, naturalistic, stylized or abstract. The Chinese of the Sung period, and still more their artistic descendants the Japanese, inclined to asymmetry in their decoration, whereas we in the West have in the main shown a preference for symmetry in-

herited largely from Greece and Rome. It is not a question of one approach being better than the other, or of a strict limitation of either to East or West, but of an increased richness obtainable by a fusion of the two. In pots especially, regularity of form seems to call for an irregular element in decoration, and an antithesis widens the range of expression. Furthermore, pattern in general and asymmetric pattern in particular, from practical as well as aesthetic reasons, should be stated with the greatest brevity and certitude. This must not be taken to suggest a mechanical perfection of touch, because the swiftness of really good brushwork on pots is full of nervous energy and irregularity of touch.

It is a rare thing to find good new patterns; but it is not so long ago that they were being produced in conformity with tradition by able but now forgotten craftsmen and artisans of the people. Such craftsmen hardly exist to-day, for the function of the artisan has passed into the hands of a few conscious artists who rarely attain to a like simplicity of heart. The problem of producing vital pattern is a very real one to the artist-craftsman. He can no longer depend upon the support and restraint of any particular tradition but must form his own synthesis and invent his own creative designs, for pattern should rise out of the need and experience of to-day and not from that of yesterday.

The most fertile and vigorous maker of patterns in Japan is Tomimoto, and when he and I first tried to produce our own decorative motifs twenty-five years ago, we used to go out to nature looking for simple forms in birds, clouds, leaves or flowers which could be seized upon with a few swift lines conceived as brushwork, inlay, slip-trail, or sgraffito. The brevity of the impression and its statement insured some measure of translation as well as simplification. Even so our drawings were often too laboured and had to be modified for each individual pot. What we sought to capture from nature was some small but significant portion of the beauty we had seen; but only when it

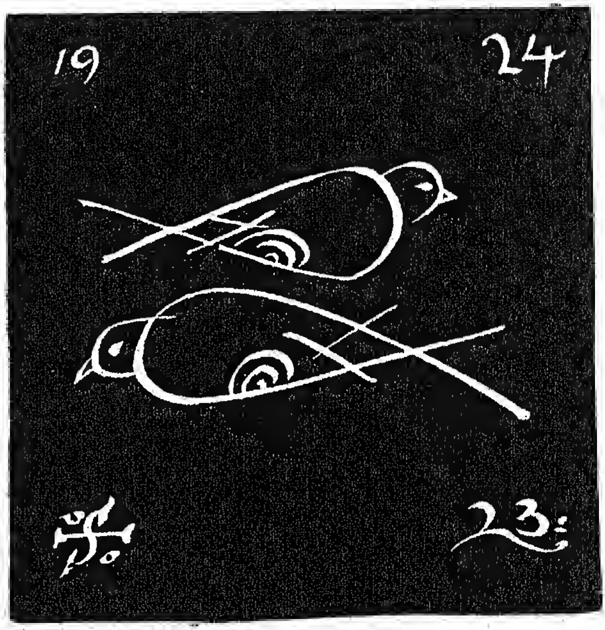
no longer imitated the external object and acquired an irreducible related form of its own did either of us feel that we had begun to discover a way towards making living patterns. One may almost go so far as to say that it is that element in the

Landscape pattern by K. Tomimoto

pattern which is unlike the natural object which gives it piquancy and a deeper verisimilitude. Imitative realism can only have a confusing effect on the decoration of pots, and when it is carried to the extent of three dimensional representation the results are almost invariably bad, for the pot itself provides the third dimension.

Although many primitive patterns look as if they were completely abstract, it is nevertheless true that most of these traditional patterns have a descriptive, literary or symbolic origin. Constant repetition of the same pattern over long periods of time results, moreover, in the gradual loss of representational

elements and the substitution of increasingly abstract rhythms which are often more beautiful and more suitable to their purpose. Two years ago, when staying with Mr. Hamada, I had a unique opportunity of observing this change in actual process.



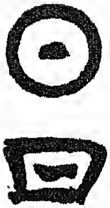
Swallow pattern tile by the author

In the small potter's town of Mashiko there lives an old woman named Minagawa, who is the last traditional painter in that part of Japan. Wholly uneducated and quite illiterate, she has some thirty patterns at her command, which she paints on teapots with dog's hair brushes of her own making with an incredible speed and light dryness of touch. In a single day she is capable of decorating a thousand pots, and lives happily on what would be in England an excessively low wage. In modern Japan, unfortunately, there is little demand for work of this kind, and it will not be long before it disappears.

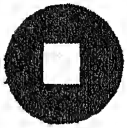
In working with her it became apparent that she was quite unconscious of the merit of the designs she painted, and her knowledge of the original subject matter of the patterns she used was limited to their traditional names, such as 'best land-scape' or 'second-best bamboo and peony'. What she did know was, from what sort of dog and what part of the dog to clip the hair for the brushes, what the consistency of her pigments should be, and how to hold the teapots so that the flow of strokes should be as rhythmic and rapid as possible. Once she paused in her work and said, 'Oh, it is a long time since I painted this pattern, I can't remember how my father painted it on the other side, I'm only an old country woman, you are educated, you'd better paint it instead of me.' In the East many if not most of the beautiful patterns on old pots were executed by simple people well trained by practice and even by children.[1] The contention of the Japanese critic Soyetsu Yanagi is that in comparison with such painting the work of trained artists is sophisticated, and that craftsmen of to-day need to recover a state where there is no strain between intuition, reason, and action.

In addition to patterns which are obviously derived from nature, abstract designs also have from the very beginning been used in pottery decoration. The preceding paragraphs illus-trate one of the many ways in which they have come into being. Potters and other craftsmen have always been attracted by symbols and geometric patterns as well, and frequently com-bined them. Many Chinese characters provide excellent examples, such as the early and late forms for mountain and sun:

[1] See Plates 49, 51, 55.



Sun,



or the more definite pattern which denotes the dual principle of 'Ying' and 'Yang', positive and negative, or the smallest coin in China, the cash, which is a square within a circle, signifying man's construction (one may say, the city) set foursquare within the circle of the universe.

Broadly speaking, there are two approaches to pattern making, objective and subjective: the one immediate and the other the result of the slow assimilative process in the subconscious mind.

It cannot be said that either method is 'best', for naturalism and abstraction counterbalance one another, and throughout the ages patterns of beauty have emerged from every point between them. Naturalism is rooted in our direct reaction to physical life, abstraction in our capacity for comparing and generalizing. The former may deteriorate into slavish imitation of nature, the latter into uninspired mechanism. Nevertheless a pot starts by being an abstract shape, and consequently any pattern applied to its surface calls for formal emphasis in order to attain unity with it. The personal or human touch which vitalizes the fusion of these two approaches I have attempted to deal with in the chapter on standards.

During the last quarter of a century geometric form and pattern have invaded every branch of European art with the force of a revolution, but it must not be forgotten that primitive and Mohammedan art are saturated with geometric concepts. The difference between such art and ours is one of development and accent. Primitive and Eastern pattern is two-dimensional and free-hand, ours is three-dimensional and more mechanical. Sense of form in the West has evolved to a stage in which free play is given to geometric abstractions of a predominantly intellectual order. In so far as this is a reflection of mechanized

materialism in modern life it offers the potter and all handcraftsmen a coldly forbidding background for their work. But, as I have already pointed out in another connection, our civilization differs from all those which have preceded it in that we are the first to have the opportunity of drawing inspiration from the cultures of the whole world and of all epochs. There is some justification therefore for the hope that our growing appreciation of beauty as expressed by primitive and Eastern artists and craftsmen will as time passes counteract the aridity of extreme intellectualization.

DECORATIVE TREATMENT OF RAW CLAY

The earliest methods of decoration were derived from the processes employed in making pots. The impress of basket moulds, for example, led to the imitation of woven patterns. Roughly fashioned tools of bone, wood or stone were used to give these repeated impressions. The actions of *beating*, *indenting*, *embossing*, *modelling* and *scraping* were all employed in shaping the pot, and it was only one step forward to use the same processes for purely decorative ends. A round jar can be beaten with a wooden bat till it has as many flattened sides as one wishes. Vertical indentations may be made with the square edge of the same tool and the angles can be softened by a wet hand or leather. Sponges are much used to-day for this purpose.

Scraping or turning is now done with iron or steel implements, but formerly pieces of flat stone, like slate, were used, and also wood such as bamboo and, strangely enough, pine with the outer bark removed. In the chapter on shaping pots illustrations are given showing steel and iron scraping tools. Bamboo is excellent. It ought to be from 2 to 4 inches in diameter, and the wall thickness $\frac{1}{8}$ to $\frac{1}{4}$ inch. The hard outer skin is always retained as the cutting edge. When bamboo is very old

and dry it becomes brittle, but I have had many pieces in use for over ten years. The kind used for making gramophone needles is just right for potter's tools. A convenient source of supply in England would probably be a large nurseryman.

Applied ornament

Clay luted to the pot as soon as the latter is hard enough to handle may be treated in a variety of ways. Prepared in rolls, pats, strips, or thin cakes, it can be twisted, notched, combed, stamped, or smeared. The Cantonese potters who turn out the large oval bath-tubs of the Far East work with a bunch of tools on a chatelaine at their waists, catching up one or another with which to perform these operations with incomparable freedom and dexterity. Medieval English slipware, although rougher, shows qualities of restraint and sense of plastic material and form which brings it closer to this kind of Chinese work than to any other.

Graving

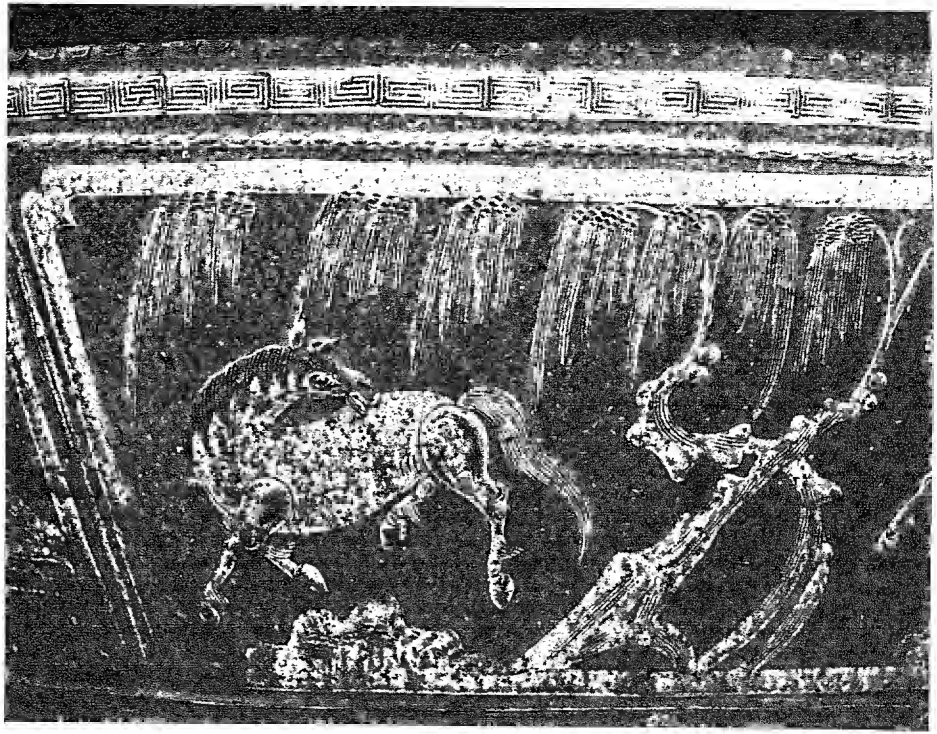
As smoother clays came into use, men began to grave pots more skilfully with various pointed tools. A sharp point leaves an unpleasantly furrowed line in soft clay, so the Chinese and Koreans used chisel-headed bamboo implements and fine combs. With these they cut the most crisp and airy patterns which have ever been put on pots. The curves full and free yet restrained. Our best penmanship is tight by comparison, for the Chinese have several different highly developed free running hands to which Western script has no counterpart.[1]

Fluting

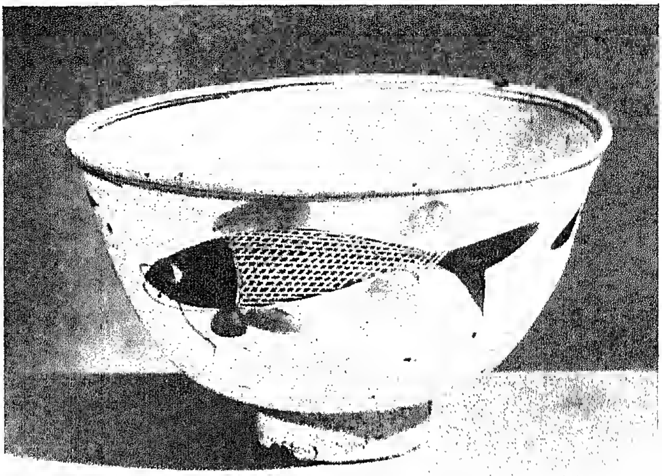
The fluting sometimes to be seen on Sung bowls was done[2] with a thin piece of metal toothed in the manner shown, and used like a carpenter's plane.

[1] See Plates 26, 34.

[2] See Plates 2, 36.



52. Detail of decoration on a large Cantonese bath tub. Ching dynasty. Applied-clay pattern, freely cut, combed and rolled. Hard galena glaze.

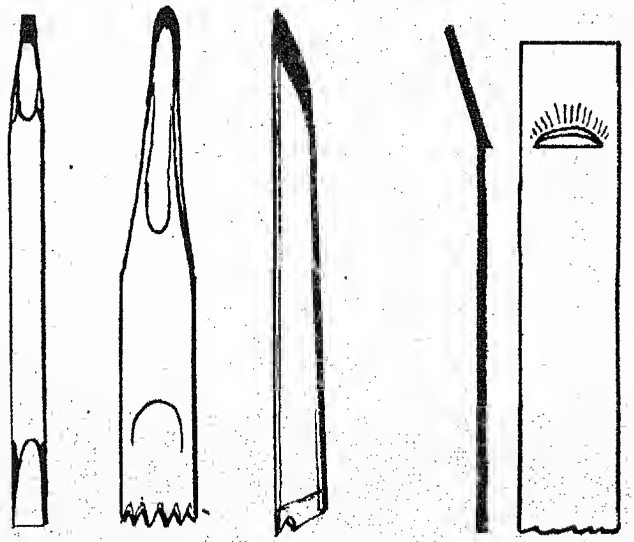


53. Chinese Stoneware Bowl, Tz'ou Chou. Sung Dynasty or possibly later. Apart from the good form and well-proportioned foot the simplification of a fish to a dozen brush strokes and scoring is remarkably direct.

54. Korean Stoneware Pot of the Ri Dynasty. Brushed white slip ('hakeme') under a powerful pattern in iron.

Stamping and Inlay

Pots from very early times were stamped with seals. These can be carved in half-dried clay and afterwards biscuited, or be made of metal, or plaster of Paris, or close grained wood. The stamp should be impressed as soon as the pot is firm to the touch. Thin pieces of soft clay can also be stamped with a

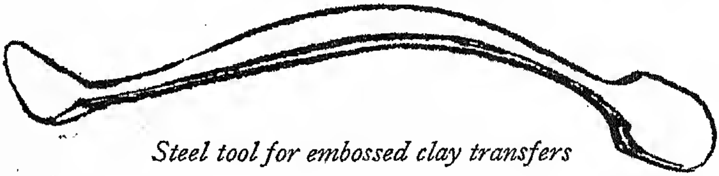


Bamboo graving tools   *Fluting Tool*

design and applied with slip to the pot. The Wedgwood factory has long been known for very delicate work of this sort. A neat steel tool is used both for pressing the material into the mould and for lifting it out again by the adhesion of the damp clay to the blade. A freer, more artistic use of such seal patterns is to be found on many German grey-beards or bellarmines.[1] Seal marks, whether positive or negative, can either be left to be more or less filled up with glaze, or they may first be washed over with a thin coating of pigment which flows into the

[1] See Plate 25.

depressions, and emphasizes the pattern. The impressions obtained by pressing the seals directly into the wall of the pot are used as a basis for inlay. Thick slip of a different colour from the body is basted well into the hollows and allowed to dry to

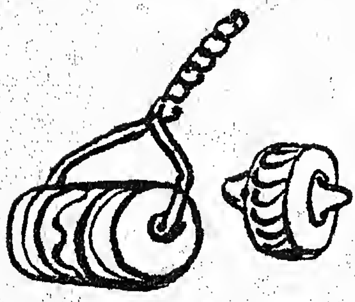


Steel tool for embossed clay transfers

the same consistency as the clay wall, and after that the surface is pared down with a shaving tool or blade until the pattern is sharply and flatly exposed. A non-plastic material such as china clay, quartz or grog should be added to a slip used for inlay to counteract unequal shrinkage. Korean potters of the Korai dynasty used this technique with great delicacy and charm, inlaying a white and a black slip and then covering the body with a delicate celadon glaze.

Engraved rollers

Roller seals, which are also of great antiquity, can be very simply made of biscuited clay with a thick wire handle attached. By their use projecting ridges or applied rolls of clay may be rapidly impressed with repeat or running patterns as the pot revolves on a wheel. The edges of old English combed oven-ware dishes were notched by this means.

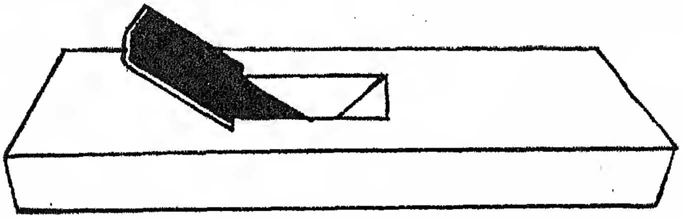


Incised rollers

Cut facets

Another method of decorating half dried pots is that of cut surfaces. This is done usually on prominent curves with a blade

like that of a table knife, or with a small wooden jack-plane the aperture of which is about twice as wide as that used for wood-



Clay plane

work. In throwing it is best to leave the walls thicker where they are to be cut, and for large surfaces it is necessary to beat the pot roughly into shape first (See Plates 47 and 48).

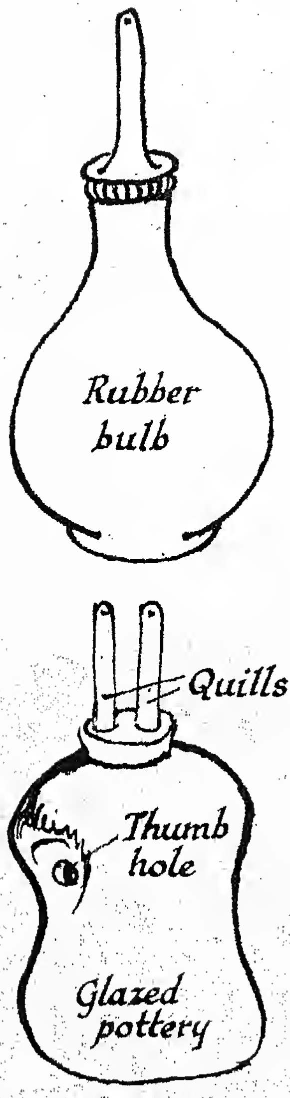
Slip Treatment

Slipping and glazing are so similar that reference should be made to the chapter on glazes to amplify what is said here. The simplest way of using slip is to dip the pot in it, either by holding it by its foot and immersing it in the liquid, lip downward, or by holding and steadying it from within and pressing it down until the slip rises to the lip. In either case the residue is wiped off with a sponge. It takes some practice to judge if a pot is quite horizontal (as it should be) when it is inverted and partially dipped, for a slanting line is very disturbing to the eye. A defective first dip may be corrected by a second, but this means a thicker coat of slip which may not be desirable. Also, if the pot is a thin one, it may absorb too much moisture and go out of shape, the colour may become too pronounced, or the slip scale off when dry. The Japanese sometimes lightly dip the side of a rounded pot and the resulting oval patch is subsequently painted and called a 'window picture'.[1] Sometimes one-half of a dish or bowl is dipped. In the sixteenth century a patch of

[1] See Colour Block C.

glaze was applied to the front of otherwise unglazed pitchers in the same manner by English potters.

It should be remembered that slips, especially white slips, are partially dissolved by a well melted glaze, consequently any variation in thickness becomes much more pronounced after firing. The same thing happens with pigments. A deliberate use may be made of this characteristic; for example, a pot with a rim on the neck which holds the slip may, after dipping, be quickly returned to a vertical position so that the excess of slip will run down in doubly thick trickles. One slip can be run over another with a jug or trailer, but this requires greater control.



Slip trailers

Slip Trailing

The most convenient type of slip trailer is a rubber bulb fitted with a cork into which one or more quills are inserted. The old potters used a clay vessel with a narrow neck and an opening or spout on one side. They controlled the flow of slip with the mouth or thumb. This tool was used with great freedom by the English peasant potters of the seventeenth and eighteenth centuries. Besides the large plates which are known

by the family name of Toft[1], various sorts of oven dishes, decorated with patterns in trailed or combed slip, were in common use all over the country until about the middle of the nineteenth century.[2] The designs were usually in white on black under a transparent amber glaze. Jugs, jars, posset pots, tygs, beakers, salts, and a curious variety of ornamental pieces were also decorated by such methods in little country potteries scattered all over England. Even as far west as Cornwall, according to local traditions, there were no less than sixteen potteries at one time or another in the Duchy. The last of these is still producing fine Cornish pitchers at Truro. They are stronger in form and better in colour than the productions of any other of the surviving peasant potteries in England.

When a trailer is used, the consistency of the slips is important, particularly when one is trailed over another while still wet, for unless they sink into one another to form a level surface the pot cannot be successfully joggled and combed. The slips must be well sieved, and it is sometimes useful to add a small quantity of gum tragacanth to ensure adherence, and to make sure of a treacly quality in their flow. Slips must be thicker for trailing than for dipping. The simple, loose patterns suitable for trailing should be thoroughly learned before the slip is applied, for there is not much time for pausing once the operation has begun. It is better to wipe out a misdirected effort with a sponge and start afresh rather than to attempt retouching. All fine and intricate lines are to be avoided and the design should be translated into terms of spacing, easy speed, and pressure on the bulb of the trailer.

Feather Combing

Combing is generally done on flat slices of clay, which are afterwards pressed on a convex mould into the shape of a plate

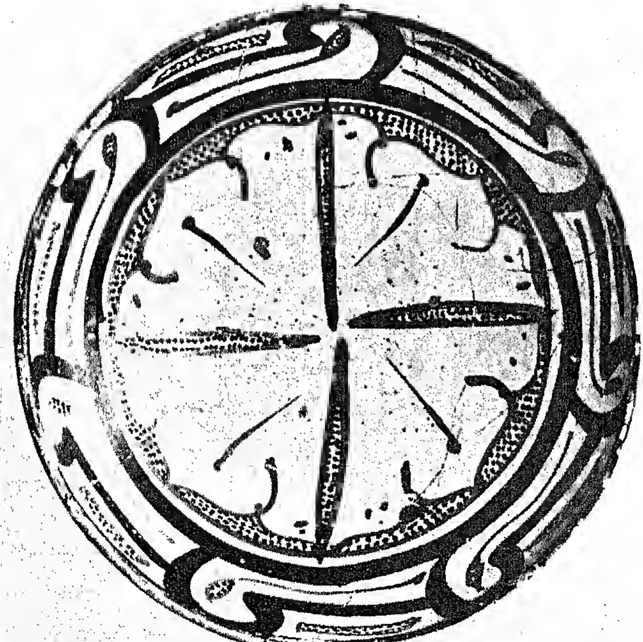
[1] See Plate 19.
[2] See Colour Block B.

or shallow bowl. The slices of clay are laid on round boards and the foundation slip is poured over them and drained off. After a few minutes, but before the wetness of their surfaces begins to dim, another slip is trailed across in close parallel lines, then the boards are bumped down on a hard surface. This has the effect of making the superimposed lines spread, but the two slips will not mix. The slip below being more liquid, especially if it contains much iron oxide, floats to the surface in a hair line unobtainable by any other means. Then a quill, which has been sharpened to a long fine point is drawn lightly across the pattern. It makes no line itself but drags one slip out into the other with a delicacy only comparable to that of the markings on some sea shells. Sometimes it was drawn rapidly backwards and forwards giving an effect of alternate brackets.[1] Combing can be applied to thrown pots too, but as may be imagined, it requires considerable dexterity.

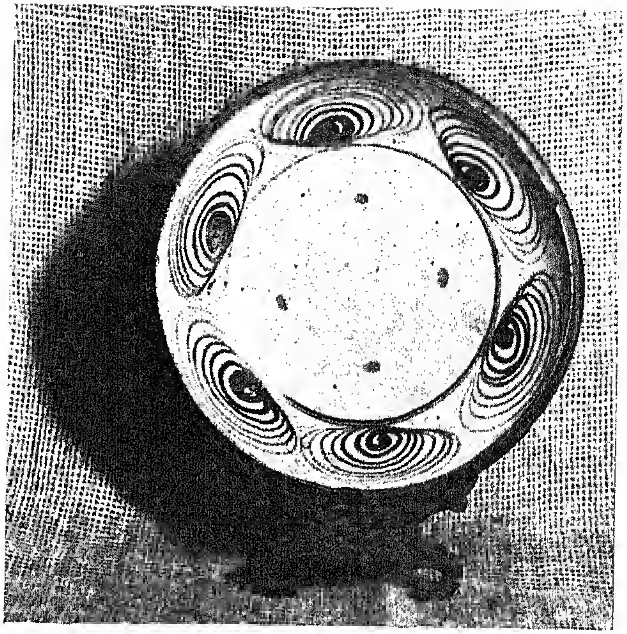
Marbling

When one or more slips have been unsuccessfully trailed over a wet background, for which black is the most suitable because of its stronger adherence to the body, it is sometimes a good plan to try for a marbled effect by violently shaking and twisting the board upon which the clay rests. The slips then run into each other and produce most unexpected and occasionally interesting patterns.[2] Another method which the old potters sometimes used with success, was to slip the inside of a bowl and then release successive drops of another slip on the rim; these ran down the inside and were then coiled by circular tilting in a spiral at the bottom of the bowl. But in all such processes, which depend to a considerable extent upon chance, one must use one's judgment as to whether the effect obtained has aesthetic merit or merely exhibits dexterity.

[1] See Plate 20.
[2] See Plate 44.



55. English Marbled Slipware Dish. 18th or 19th centuries.
56. Earthenware Dish made at Samarkand in the 9th or 10th centuries. Red and black pigment on a cream base.

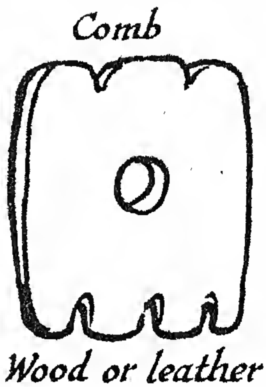


57. Japanese Stoneware Dish made at Seto, 18th or 19th centuries. 'Horse-eye' pattern.

58. Modern Korean stoneware Kitchen Pot; finger-combed glaze. A good example of the healthy beauty of common things made by ordinary artisans.

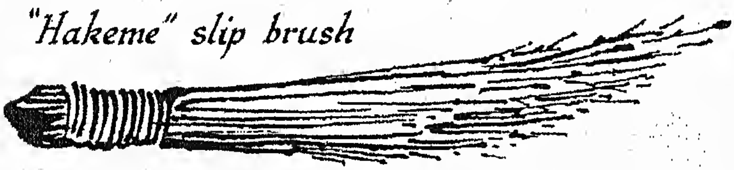
Slip Combing

A coating of wet slip may be combed with a rubber or wooden implement with rounded teeth which are more or less widely spaced. The combing is done either free-hand, or more regularly on a slowly revolving wheel, a few minutes after the application of the slip. Pattern is almost necessarily limited to a simple up-and-down movement, variety being obtained by the width and spacing of the teeth and the length of the wave, and alterations of the angle at which the comb is held.



Slip Brushing

Liquid clay is not a very suitable medium for brushwork because the colouring matter in it is liable to vanish in the glost firing. If, however, it is laid on thick, certain good effects can be obtained. The most notable in the East are the coarse brushings of white slip called *hakeme*[1] on early Korean pots as well as on



bowls made from the fifteenth to the seventeenth century by Koreans in Karatsu, Japan. These were done with a miniature garden broom made of the grain ends of rice straw. The unconscious beauty of the Korean work has always been deeply felt by Japanese connoisseurs, but Japanese potters have rarely, if ever, been able to equal it. Our European technique, called

[1] See Plate 54.

pâte sur pâte, which is a sort of brush-built modelling developed in France in comparatively recent times, is a very different thing. It would be difficult to find a better example of what should not be done with clay.

Stencils

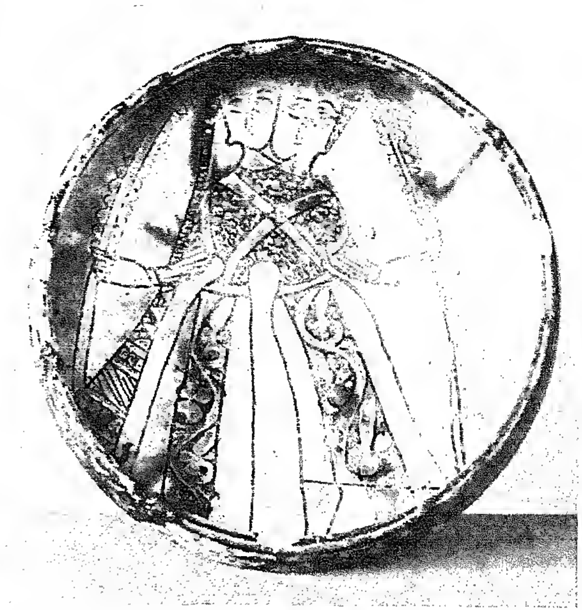
Stencils, cut out of paper or thin sheets of pliant metal, may be pressed against the surface of a pot and pigment brushed or dabbed over them. Positive or negative *paper patterns* may also be stuck to the damp surface of a raw pot, which is then dipped into slip; the paper is subsequently removed.[1] Sung potters not only employed this device, but even occasionally used the green leaves of plants for the purpose. It is a method, however, which easily lends itself to meretricious effects, but this entirely depends upon the person who employs it. As stencil printing is in flat tone with a slight emphasis on the borders where pigment accumulates it is advisable to keep the patterns simple and large, and diversify them if need be by other treatment such as graving or sealing.

Rubber Stamps

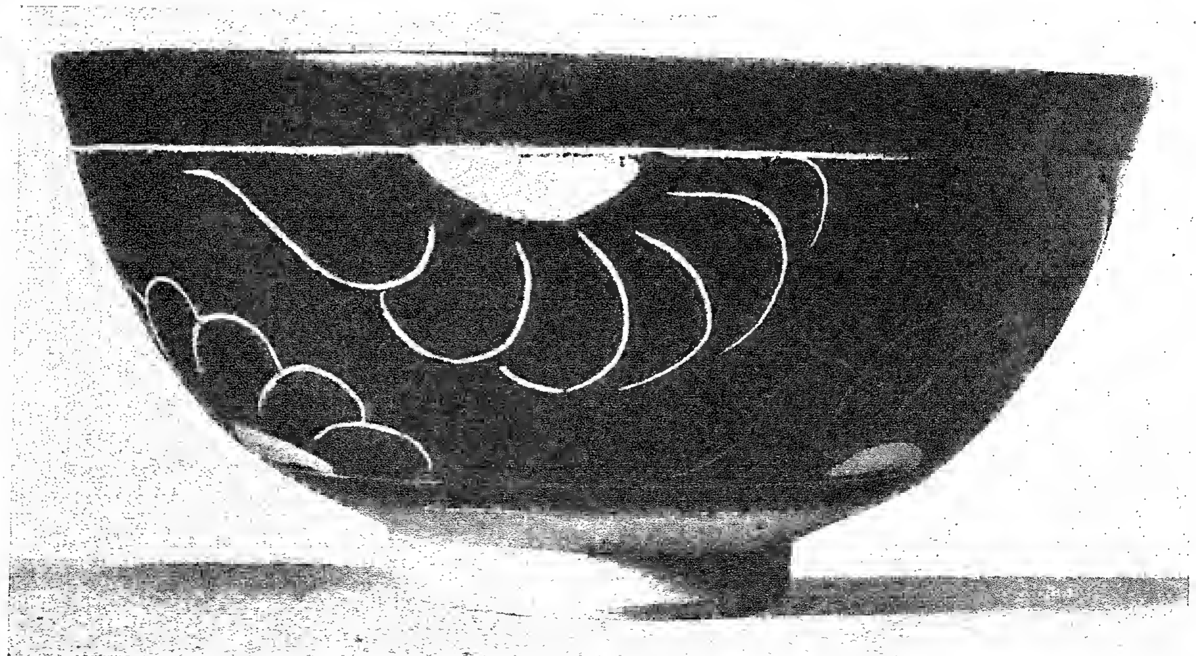
Using a pad saturated with a mixture of finely ground pigment and water, and a siccative if need be, rubber stamps may be charged with colour and applied to biscuit ware in the same way as letters are postmarked. Ordinarily such stamps are made of non-absorbent indiarubber, and for this reason the pattern is best limited to comparatively thin lines. But during the last few years the Japanese have made extensive use of fine sponge-rubber, which they cut to any pattern with astonishing skill. The consequences of this 'improvement' have been disastrous, because hand-painted pottery has almost disappeared from the Japanese market. The new patterns are sometimes the same as the old, and through a shop-window it is difficult to tell one

[1] See Chap. VIII, pp. 229 and 230.

59. Stoneware Plate, stencilled, trailed and sgraffito. By the author.



60. Byzantine Lead-glazed Sgraffito Bowl. 14th century. An unusual and very interesting type of decoration.



61. Raw 'Tenmoku' Glazed Bowl with the pattern cut away. By the author.

from the other. A closer examination, however, discloses the method, and in conjunction with cruder colours, vulgar patterns, and mechanized shapes and finish, the effect is deplorable. But there is no inherent reason why this kind of stamp should not be employed in a straightforward way for pattern and colour.

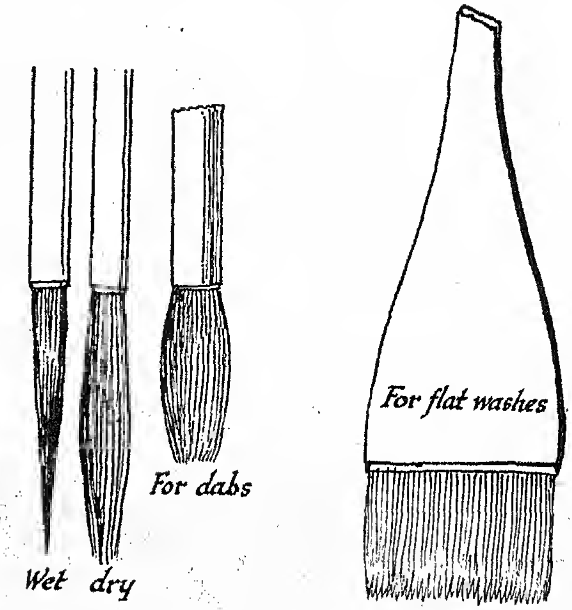
Engraved and Washed Biscuit

Upon a fine soft-biscuited porcelain body it is quite easy to engrave lines with a steel point. It is very much easier than making a dry point etching on a copper plate, which first brought the idea to my mind. After the design has been drawn a good diluted blue pigment can be lightly washed over the whole with a broad flat brush. The colour lies thicker in the lines, and the plain surfaces may be wiped almost clean with a sponge. Several darker tones of blue may then be added if required. Finally, light lines can be cut through any of these layers of colour. This treatment lends itself to delicate as well as free pattern.

BRUSHWORK

The use of the brush is in itself a wide subject, especially to anyone who has lived in countries where a hair point takes the place of metal implements for writing. Our Western use of the brush is comparatively limited, not so much from lack of skill as from ignorance of the range of brush-drawn line open to Oriental peoples who seriously regard their lettering as a means of the highest artistic expression. Compared with the flexibility of a brush, a stilus, a graver or a pen only allows play in one dimension. We are accustomed to pushing, prodding and scratching, but not to the feather-weight touch of soft brushes. If to-day we knew something about the craftsmanship of our own writing it would provide us with a reasonable

point of departure for the investigation of a more highly developed art, but very few of us do, and a suspicion arises that there may be something the matter with a people who have become literate and yet have lost the skill of the pen. Artists, in so far as they are artists, have perceptions which transcend training,

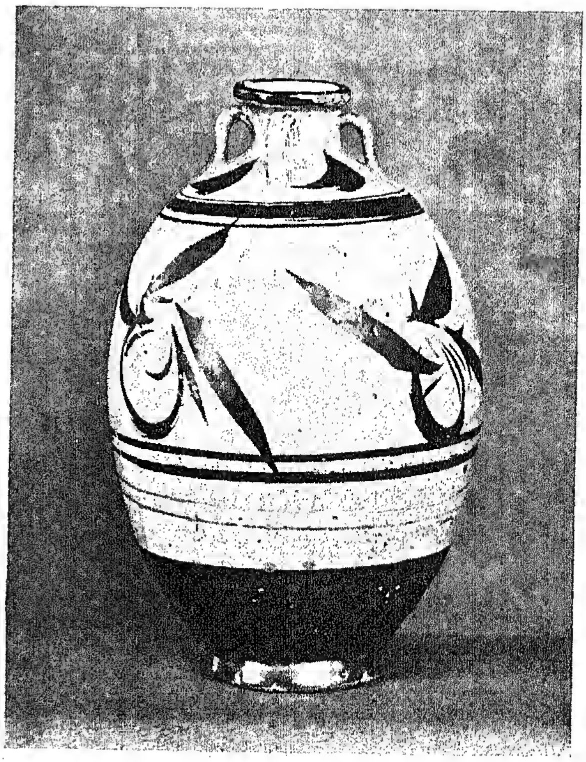


Japanese brushes

hence the many draughtsmen we have produced whose touch was instinctively good. For this reason Japanese who are familiar with Western art, and they form a considerable proportion of the educated classes, are not slow to recognize the greatness of a Rembrandt by his pen drawings. It is too much to hope that many Europeans will arrive at a corresponding appreciation of Oriental calligraphy, but the knowledge of Far Eastern painting is spreading and there can be no better introduction to it than that provided by the brushwork on Sung and Yuän pots.

62. Spanish Peasant-ware Plate painted with manganese and copper on tin enamel. 16th century.

63. The back of a Large Hispano-Moresque Bowl painted in copper lustre on tin enamel. Hamada spoke of this brushwork as the best in Europe.



64. Stoneware Bowl, rust on oatmeal. Staite Murray, individual English potter.

65. Sung Tz'ou Chou Bottle. Oxidized stoneware, brown on cream. This was the great period of Chinese brushwork on pots.

The brushes used in the Far East differ from ours in certain important particulars. They are usually made of several different kinds of hair, such as cat, badger, deer, and dog, scrupulously selected by hand and even by the tongue. The hairs are all perfect, that is to say, they are chosen from such parts of the animal, e.g. the back of the neck and the top of the tail, where there is least friction, for there the hairs have grown to fine tapering points. Needless to say, they are never trimmed. The longer harder hairs are placed in the centre to provide a springy core, and around these, other softer kinds of hair are gathered. A brush made in this way will give fine as well as broad lines. The resilience of the core necessitates a more or less upright action of the brush and definite stroke production, in order that the painting may have what is called 'bones', or, in other words, structural character. The brush is mounted in a long bamboo stem and is held well away from the point, and the painter's or writer's action is more from the elbow than from the wrist.

The kind of brush described above is by no means the only type used in the Orient, but with it and a few flat brushes for washes, and short round ones for dabs, all the painting which studio pots require may be done.

The best brushwork in Europe on pottery was done by the Moors in Spain. The Moors derived their tradition from the lustre painting on tin enamel of Persia, Syria and Eygpt, which reached its climax at Rhages in the thirteenth century. Chinese pottery and porcelain had already been exported to Persia in the seventh century, but after the conquest of China by Genghis and Kublai Khan in the thirteenth century the ceramic interchange between the Near and Far East became very marked. Mohammedan culture extended from Valencia to Peking, and it is not surprising that occasional pieces of Spanish or other Mediterranean wares should remind one of early Chinese work. Despite the imposition of a Mohammedan style of intricate arabesque and geometric backgrounds, the breadth and vigour of the heraldic brushwork, especially on the backs of the large

Hispano Moresque dishes, is astonishing. The touch of the brush is both broad and keen, and in its contrasts of thick and thin line is reminiscent of that on the painted wares of the Sung dynasty. By contrast, Italian majolica is generally weak, ornate and closely allied to third-rate Renaissance painting. North of the Alps a homely bourgeois intimacy preserved the Delft tile painters from neo-classic weakness. In the attempts, moreover, to copy Chinese blue-and-white porcelain, the Delft potters learned a great deal about Chinese brushwork, and often applied their knowledge successfully. Frequent reference is made by writers on ceramics to the difficulty of painting on the porous and friable surface of tin enamel; but it may be pointed out that this only had a deterrent effect upon niggling painters and was on the contrary a spur to the free use of the brush on the absorbent surface of either soft biscuit or raw enamel. In some of their simpler polychrome Delft plates and drug pots the Dutch potters, and occasionally those of Bristol and Lambeth, achieved a great charm of colour and pattern. The white tin-glazed sack and claret bottles made at Lambeth in the seventeenth century are good and at the same time genuinely English in character.

With the following century industrialization began in England, and gradually swept across Europe, step by step displacing the hand by mechanical power. Small potteries continue here and there on the Continent to carry on the ancient tradition, but the patterns even more than the shapes have lost their vitality. The decoration used in factories is largely in overglaze enamels, diluted with oil instead of water to suit non-absorbent surfaces. It seldom rises to a higher level than the charm of detailed prettiness, while the underglaze painting was soon largely replaced by transfer printing. This was a pre-photographic age in which the graver was laboriously employed for reproducing pictures for many of which it was eminently unsuitable. Its invasion of the surface of pots by means of facsimile prints from engraved copper plates in potter's colours

saw not only the death of free pattern painting, but was also a further stage in the division of labour, which, however necessary for mass-production, has destroyed the unity of conception and execution in the completed article. That certain dignified effects were occasionally obtained by transfer printing, despite this handicap, must be attributed more to the designer on paper and the engraver than to the potter. The differences between the Spode willow pattern and the brush painting in bluc on the Chinese porcelain, from which it was derived, illustrate both these points.

As orthodox Oriental calligraphy and brushwork are obviously beyond our capacity, the most practical advice which can be offered to an Occidental student is to obtain some good brushes[1] and learn from steady practice what they will naturally do, and so to acquire a limited range of free stroke production. In this study, thoughtful observation of what the Chinese, Persian or Spanish potter did with a large fully charged brush should provide the best background. Brushes deserve and repay respectful treatment. They should be washed after use, and carefully pointed, before they are put away. Moths have a great liking for the hair, so when brushes are not in use they should be rolled up in paper with some naphtha powder or camphor.

When painting, it is advisable to hold a pot at some distance from the eyes, and to grasp the brush well away from the point, in order to see the work as a whole and paint with freedom. Gainsborough's outburst to a lady who was examining one of his paintings through a lorgnette, comes aptly to mind. 'Madam,' he is reported to have said, 'my paintings are made to be looked at, not smelt.'

Banding

If the curvature of freely thrown pots is analysed it will be found that it is usually divided up by natural emphasis into

[1] See the list of materials at the end of the book.

constructive movements. Potters of all countries have been inclined to add further emphasis to these slight but life-giving angles by banding. This horizontal spacing of the areas of a pot with circles gives a unity between decoration and form, but no hard-and-fast rule can be laid down because the mood in which a pot is conceived must be given preference to any formalism. The bands are made with a brush held steadily at a slightly oblique angle to the spinning movement of the wheel. Circles can be made either freely or with mechanical precision. Free banding is never seen on industrial pots, indeed it would be out of place upon such precise forms, but freely thrown pots call for a spontaneous touch. This is nowhere better illustrated than on the T'zu Chow bottles of the Sung and Yuän eras, where the contrast of thick and thin line is most alive.

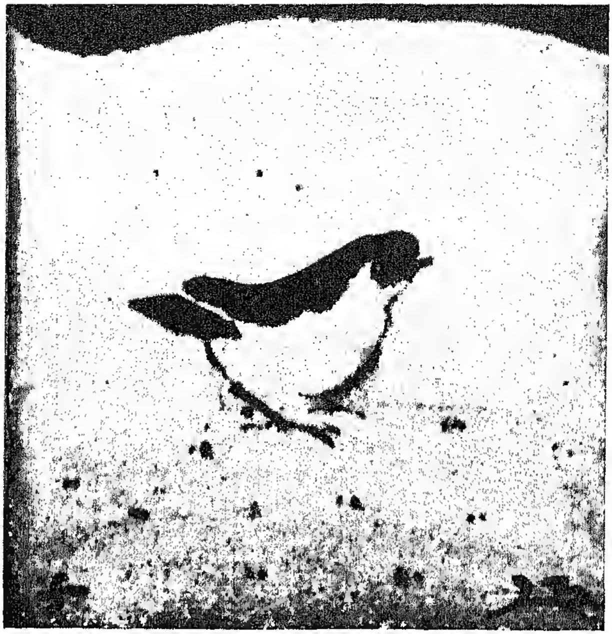
Pattern Painting

Patterns, whether used in conjunction with banding or without it, fall into several categories, such as single, repeated, and all-over, any of which may be symmetric or asymmetric, naturalistic or abstract, or used in one or another combination. A series of drawings of a simple shape, treated in different ways, may give a visual impression, and suggest the endless variety of decoration which can be used on the same form.

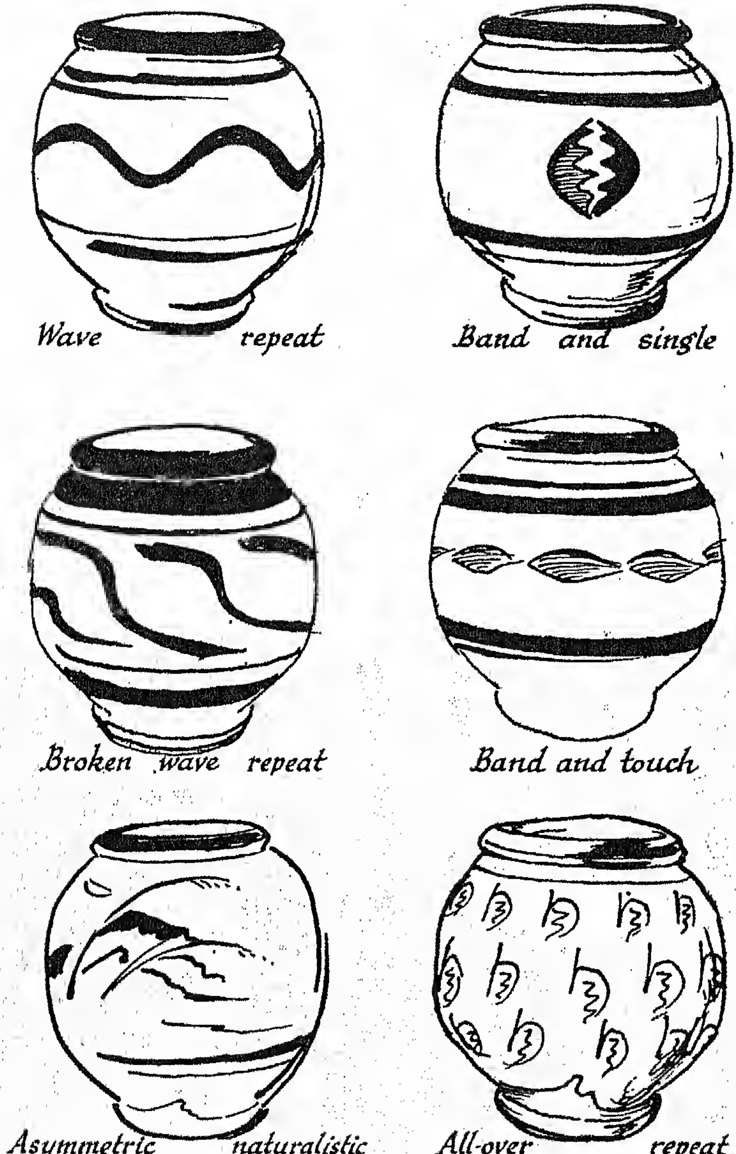
The last four types have already been dealt with, and with regard to the first three, single, repeated, or all-over, it need only be said that although the shape of a pot may be suggested by a decorative motif, the more natural process is to conceive a pot for a definite purpose and then consider what pattern, if any, will give it an added beauty. The beginner will be well advised to explore the possibilities of bands, dots, natural brush strokes and the simplest wave movements as a foundation for abstract design on pots.

66. Greek Earthenware Bowl, 19th century. Dull orange and manganese brown on a cream slip. The affinity between these pots is too strong to be overlooked. The shape of this modern Greek bowl is pure Sung and the brushwork speaks for itself (see page 119).

67. Chinese Stoneware Jar of the Sung Dynasty. Tz'ou Chou Ware. White slip painted with iron pigment, oxidized firing.



68 and 69. Stoneware Tiles painted by the author.



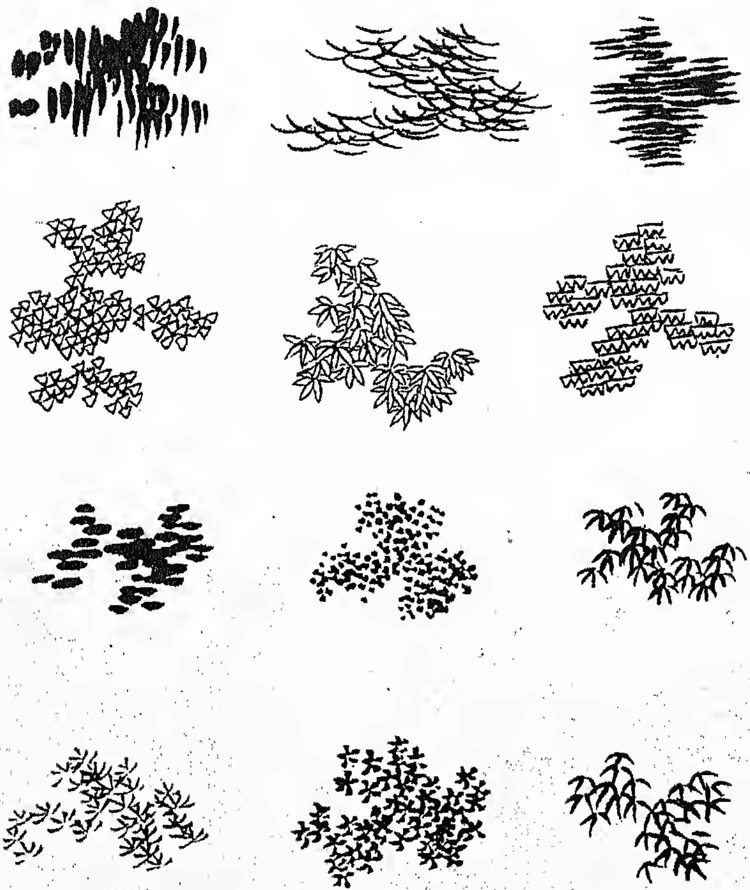
Different types of pattern on the same form

TOUCH

If it is true that nothing betrays a man more than his handwriting, this is doubly true of brushwork. In the flow of the soft point his real character is revealed. Decision or hesitation, sensibility or dullness, breadth or narrowness, tenderness or sentimentality, are all nakedly exposed. Why then, since at best it would only seem to be a disguise, should a student struggle to develop a technique of brushwork? The real value of such a training, however, is not to acquire technique as an end in itself, but as a means to an end. The only risk is that of losing sight of our objective; the gain, and it is one which we instinctively feel, lies in finding a way out of our weakness as the brush reveals it to us. The degree to which artists and craftsmen are able to endure the visual evidence of their actual selves, when it is brought home to them by their own hands, depends largely upon the depth of their love of beauty. The value of a living tradition is that it makes this kind of training more accessible to those who are capable of acquiring it.

I possess a set of a dozen volumes of Chinese exercises in brushwork which have been used for centuries as the basis for the training of painters. The books commence with simple stroke production, wet or dry, fast or slow, representing, for example, leaves according to tree, age, or season. From the single leaf, in some sixty arbitrary conventions, it proceeds to sprays, branches, whole trees, combinations of trees, complete landscapes with waterfalls, mountains, valleys, overhanging rocks, and a sage's hut with the poet himself meditating unobtrusively. The book is in fact an impersonal epitome of what the Chinese consider to be good brushwork. A dignified formal treatise by the aid of which the budding Chinese artist can gather together, under the guidance of a master, a store of classic subject-matter and sound technique, and with which, if he has personality, he can approach nature for original inspira-

tion. Almost all Chinese painting which we admire, including that on pots, derives from the solid foundation of brush writing and this subsequent training.

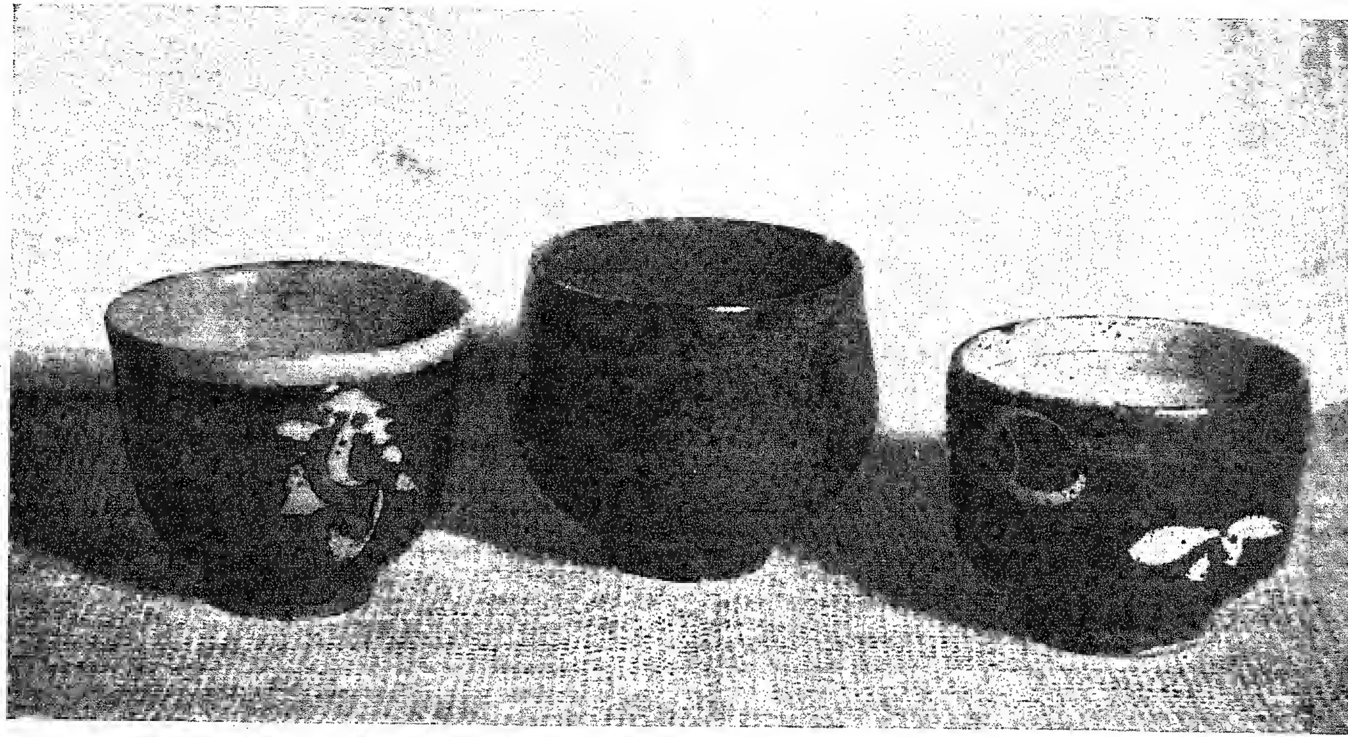


Some Chinese brush-work leaf conventions

Without masters to set standards, schools in which to acquire them, and a public with which to keep in living contact through its own experience of good craftsmanship, no more can be done

than indicate where the best traditions flourished, and how they worked, and leave it to the individual to pick up what he can for himself.

The use of *engraved transfers* and the *aerograph* I shall not touch upon as they hardly concern hand-made pottery. *Wax resist* and *glaze on glaze* decoration I have already described in the chapter on glazes.



70. Three Stoneware Tea-bowls by Shoji Hamada, Japanese individual potter (in the possession of the author).

Left, wax resist pattern over clear glaze but under a 'Kaki' dip
Centre, ochre slip, clear glaze, magnetic iron brushing and a last coat of clear glaze
Right, clear glaze, wax resist, magnetic iron brushing and a final coat of clear glaze

71. Tall Oxidized Stoneware Bottle, the brown pattern painted over the white matt glaze. By the author.

Chapter VI

PIGMENTS AND GLAZES

Primitive man employed a variety of ferruginous clays and powdered rocks for decorating pots long before the art of glazing was developed. Somc of them were slips and others were pigments but there is no sharp line of division between the two. Slips, or engobes, are clays modified by small proportions of oxides, natural or introduced, and pigments are predominantly metal oxides.[1] At low and medium temperatures fluxing agents such as lead and borax cause pigments to adhere to the clay beneath them and to combine satisfactorily with the glaze over them. Silica, added to oxides beyond the proportion required by the fluxes, acts as a stiffener preventing the pigment from flowing, whilst china and other clays, tin and zinc oxides opacify and dilute the colour. In the East it is unusual to add fluxes to underglaze stoneware pigments because at 1250° C. and over, iron, manganese, copper and cobalt fuse sufficiently with clay and glaze.

Clays, slips, pigments and glazes are all subject to the prevailing atmosphere of a kiln but as soon as the glaze commences to melt the surfaces beneath are sealed against any further alterations of colour, therefore it is extremely important to control oxidation or reduction, as the case may be, for some considerable time before that point is reached. When reduced effects are intended it is advisable to employ metal compounds which contain less oxygen—ferrous and cuprous oxides, for example, instead of ferric and cupric—and in certain cases [2] it

[1] The preparation of slips is described in the chapter on *clays*.
[2] See page 129.

is helpful to add carbon to the pigment or glaze to assist local reduction. The reciprocal action of fluxes and metal oxides on one another is varied and potter's pigments cannot be indiscriminately mixed like paints. The effect of one ingredient upon another can only be learned slowly from experience. The greater the heat of a glost firing the more limited the palette. Metals with low melting points tend to volatilize, and iron, the most useful of all, will not provide the potter with a warm red for hard fired wares at much over 1000° C. Oxides are generally employed in the form of chemically refined and well ground powders, but in the East, natural or partially prepared oxides or metallic compounds are commonly used in traditional potteries, and a good deal of washing, calcining and grinding is done by the potters themselves and they are able, as a consequence, to make use of any inherent impurities.

This fact accounts for greater irregularity and at the same time a charm of broken colour and texture which is foreign to an industrialized technique. The *magnetic iron* pigment, for example, used by Hamada for stoneware is a crushed rock, only slightly ground, which when brushed on a pot dries with a brown sandy surface. The granules are fluxed by the melting of the glaze but the impurities in them form various chemical reactions in an atmosphere which alternates between oxidation and reduction and produce the broken colour referred to above.

Colours used for delicate brushwork require long and fine grinding, such as *red iron peroxide*, or *colcothar*, employed as an overglaze enamel, and the *impure cobalt oxide*, with which Chinese, Korean and Japanese porcelains were painted from the fourteenth to the latter half of the nineteenth century.[1]

[1] Imported cobalt then began to take its place, a change, now almost complete, which is responsible for the harsh and brilliant blues of modern Oriental porcelain. It may appear strange and unfortunate to us that the Chinese and Japanese should abandon the use of their beautiful native colours, but the explanation is to be found partly in the reliability, cheapness and strength of European oxides, but more in the general unconsciousness of abstract beauty which prevails amongst Eastern craftsmen.

In some Japanese potteries one may still find an old woman constantly employed grinding Chinese cobalt with a pestle and mortar whilst she reads or talks to the workers. Pattern painters have told me that hand-ground pigments are more sympathetic for fine brushwork than mechanically ground colours of an equal fineness. In looking for the cause I came to the conclusion that the irregular movement of the pestle held by the hand produced a greater variety of minute particles of colour, and in later years it was interesting to discover from English colour manufacturers a scientific corroboration for this theory. This *gosu*, or earthy cobalt, is found in certain river beds in China as a dark olive pebble, called by us *asbolite*, which shows on spectroscopic examination the presence of no less than seventeen other elements besides 10 to 30 per cent. of cobalt. The most important impurity is manganese. No ordinary mixing of iron, nickel, manganese and European cobalt will give the same underglaze blue on a porcelain body, and in order to make a synthetic substitute it is necessary to combine the precipitates of these metals. To dilute *gosu* for painting on porcelain strong tea is used instead of water.

Various shades of blue may be obtained by mixing oxides of iron, manganese and zinc with black cobalt. Zinc makes a bright blue, iron gives a brownish or greenish hue according to the degree of oxidation or reduction, and manganese introduces a violet note. Tin oxide and clays, particularly china clay, dilute and opacify the colour.

Copper green can only be produced in an oxidizing atmosphere. Green copper carbonate is employed for this purpose in Japan.

An *underglaze red copper pigment* used in reduction by Mr Kawai is composed of:

Black copper oxide	60	
Zinc oxide	28	+ 10 per cent. barium oxide
Tin oxide	3	to intensify the red.
Hard carboniferous ash	9	

He uses rice straw ash for which wheat straw or husk is an equivalent. The particles of carbon contained in it assist local reduction.

Greens may also be prepared from chrome oxide, but although stable at high temperatures they are inclined to be heavy and to show an unpleasant yellowish fringe.

At St. Ives we make a *dark brown* pigment by adding two parts of white slip to spangled or magnetic iron oxide.

Pigments are occasionally used over instead of under viscous stoneware glazes, but in order to avoid rough metallic effects some flux should be added to them. I have found for example that *our magnetic iron pigment* with about 25 per cent. of glaze added to it will give a silvery metallic quality when reduced and a red rust when oxidized.

As an alternative to coloured slips or glazes underglaze pigments or stains may be applied to biscuit ware by a soft broad brush, or by dipping, spraying, etc., but as it is more difficult to obtain an even coating in this way such treatment is best reserved for deliberate effects of broken colour.

For a fuller and more scientific treatment of the subject of pottery colours the reader is referred to the chapter on decoration in Emile Bourry's standard work, *A Treatise on Ceramic Industries*, translated by Alfred B. Searle. Scott Greenwood & Son, 1926.

KENZAN RAKU PIGMENTS

Black	Chinese cobalt	67	To replace Chinese Cobalt	Manganese oxide	40
	White lead	7		Black iron oxide	30
	Frit	26		Black cobalt oxide	20
				Calcined ochre	10
White	China clay	40	The frit in each case is the same as that described for raku glaze.		
	White lead	40			
	Frit	10			
	Quartz	10			

Red	Biscuited ochre	62	The ochre should be a light brick red after biscuiting at 700° C. Grind thoroughly.		
	Bright red iron oxide	8			
	White lead	15			
	Frit	15			
Green	Copper carbonate	19	*Brown*	Black pigment	50
	White lead	26		Red pigment	50
	Frit	48			
	Quartz	7			
Yellow	Antimony oxide	$2\frac{1}{3}$	*Blue*	Smalt	25
	White lead	$32\frac{2}{3}$		White lead	$37\frac{1}{2}$
	Frit	64		Frit	$37\frac{1}{2}$
	Red iron oxide	1			

Smalt at the time of the first Kenzan was a powdered blue glass containing impurities which might be imitated to-day by adding 10 per cent. of powdered sherds and 1 per cent. to 5 per cent. of iron oxide to modern smalt.

GLAZES

As clothes are to the human body so are glazes to pots. Both serve practical ends, both should enhance inherent beauty of form. The covering of clay shapes with glazes, or glasses (for a glaze consists of, or resembles, glass), makes them smoother to the touch, cleaner and more varied in colour and texture, and in the case of pottery fired at a low temperature, more impervious to fluids. Thus the potter has kept pace with the general increase of knowledge of the art of living, or culture. Higher temperatures give more durability and less porosity, and ultimately we arrive at white translucent porcelain. When that stage has been reached there is little more scope for the inventive energy of potters than to pass over in review the whole technical and aesthetic evolution of ceramics, selectively, as we have begun to do.

That the clay vessels made by primitive peoples were not glazed suggests a parallel to their own familiarity with nudity, nor does it seem inappropriate that they should have had the greatest feeling for naked clay forms. With our multiplicity of clothing we have become sophisticated and ashamed of our bodies, and, in a manner no less apposite have completely covered our pots with glazes. The beauty of clay is forgotten, and still more that exquisite relationship between clay and glaze which is to be seen at its best in classic Oriental pottery.

In our commercial wares we have sacrificed the finer aesthetic utilities to quantity, uniformity and cheapness. Bone china is fired in such a way that the glaze must be thin and uncrackled, thereby fundamentally restricting the opportunities for beauty, for it eliminates the possibility of textures and qualities of glaze as shown in the glazes of the Chinese, and confines improvement to form and pattern.

Here, however, it is our intention to deal with the preparation and use of glazes which can by their nature yield depth and play of colour, and richness and variety of unforced texture. But first I should like to amplify a little further the question of the relation of glazed and unglazed surfaces in a pot.

The late Mr Joseph Burton was convinced that this characteristic of Sung pottery and Japanese 'Tea wares' was due to ignorance, and that with our greater scientific knowledge such treatment of glaze and body could only be regarded as an affectation. Whilst agreeing that the mere imitation of the Sung manner would be an insincerity on the part of the modern potter, I know that there is a considerable body of informed opinion in the West, as well as in the East, which warmly appreciates this turning of a necessity into a virtue, and is not at all impressed by the fact that it was at one time found expedient when using a thick flowing glaze to cover only half or two-thirds of the body, because of the danger of the glaze running down and causing the pot to adhere to its kiln support. Another aspect of this practice, and not the least important, is

the pleasure which some of us, besides Orientals, obtain from the happy contrast between glazed and unglazed surfaces, as expressed for example in the poetic description 'purple lip and iron foot' given by Chinese scholars to certain Lung Ch'uan celadons. A faint magenta tinge, due to the greater exposure of the reduced iron-bearing clay, is apt to show where the glaze runs thin on the edge of bowls, etc., and the 'iron foot' is caused by the oxidizing action of the final stoking of the kiln on the same unprotected unglazed ferruginous clay, flashing it to a red rust.[1]

Glazes and pigments vary in their character according to the temperature at which the glaze matures, and the ingredients of which they are made, and as I am giving the results of my own experience in this book I am therefore describing such as are used in:

'*Raku*' (a soft Japanese faience) fired at about			750° C.
Oriental Enamels	,,	,,	750°– 850° C.
English lead-glazed Slipware	,,	,,	900°–1100° C.
Salt-glaze Stoneware	,,	,,	1220°–1280° C.
Oriental Stoneware	,,	,,	1250°–1350° C.
Oriental Porcelain	,,	,,	1300°–1350° C.

But before turning to these in detail, it will be best to state some of the general principles upon which glazes are based. This is the more important for the reason that the usual modern approach is from chemical theory, whereas mine is mainly derived from the practical experience embodied in tradition, verified, and sometimes varied, by my own practice.

The essential element in a glaze is the fluxing agent: the substance, be it *lead*, *borax*, *soda*, *salt*, *limestone*, *magnesia* or *wood ash*, which causes the other ingredients to melt or flow. It might be considered by way of analogy as the life blood of the glaze. In contrast to it is the hard, heat-resisting silica, generally

[1] It will usually be found that where this takes place a very thin coating of volatilized salt accompanies the discoloration.

in the form of flint or quartz, which also plays an essential rôle in all glazes. This may be called the bone of the glaze. To these two a third element, analogous to the flesh of a glaze, may be added, but as it is not always present (in salt-glaze, for example) and is obtained from more varied and complex substances, such as frits, feldspar, tin oxide and clay, it cannot be adequately described in a brief statement. To it is due the fatness, depth and subdued brilliance of glazes which one feels instinctively have most quality.

During the last century we have suffered from far too many ingenious attempts to make pottery look like anything but what it honestly is; even metal, glass and wood have been imitated. Besides this, during the same period the industrialization of pot making has involved such a heightened degree of standardization of material that it is now no longer the universal practice for potters to know their glaze materials and to make their own glazes. It is even difficult to-day to make the old glazes, because the simpler, cruder and more natural materials have given place to others which although chemically purer, are at the same time devitalized. From the standpoint of character standardization is inevitably deadening. If the reader will bear in mind what I have already said on the subject of cobalt he will find it is not an isolated case, for the same principle runs through most of our commercial practice, and is inherent in all mechanical processes. Quantity may necessitate standardization but not false standards of beauty, and in the trade it is not only the necessities of large output which rule but false conceptions of beauty. As far as glazes are concerned, part of the trouble is a forgetfulness of what constitutes character of material. At the moment in other trades besides pottery this is being increasingly felt, both here and on the Continent, but as a rule a certain lugubrious element in English taste makes our decorative efforts look dull beside the French for example. When we think of the artificial and nauseating obviousness of the 'broken colours' of trade fireplace tiles, in which rutile plays the part

which open firing and less purified ingredients used to do, we can only turn with relief to plain commercial glazes. But even if we compare the plain glazes on our table-wares with the most straightforward and rather similar glazes of the Ting ware of the Sung dynasty,[1] or the porcelain glazes of the Ming period, what a profound difference there is! The one is dead, the other alive.

This 'life' in the old glazes is due in large measure to the presence of elements in the raw material which the old potters either did not know how, or did not desire, to eliminate. The most common was a small percentage of iron, which in the Ting wares produces a creamy colour, and in Ming porcelain a greenish tinge. If they had removed this and other 'impurities', as we call them, at least half the vitality and charm of the glazes would have vanished. And curiously enough, if we to-day, usually because we cannot buy our raw materials unrefined, artificially try to return to glazes their variable or inherent characteristics (for nature is never stereotyped), the results are not the same, they look precisely what they are, self-conscious. I do not say that it is impossible, with greater subtlety of perception, so to obtain moderately good results, but I do urge a return to nature if only to learn greater humility.

In the East stoneware glazes in particular were, and are still, composed of stones, ashes and clays, ground, washed, and sieved only just as much as is necessary from both a practical and aesthetic point of view. What we have done is to dissociate these two approaches, what we are now attempting is their reintegration.

Shoji Hamada once gave me the following brief summary of the evolution of Oriental glazes: In China during the later Han dynasty, A.D. 1 to 250, Taoist alchemists, corresponding to our alchemists of the twelfth to fifteenth centuries, experimented with many materials with the object of prolonging life. Lead was called by them *kobo*, or 'mother of ore', and its various

[1] See Plate 1.

properties studied. Copper had long been used in connection with tin in the manufacture of the more important articles of a bronze age. Thus the stage was set for the coming of a Persian[1] who brought the knowledge of how to combine lead oxide with copper oxide and silica (sand) to form a glaze at low temperatures for cheap clay vessels based on earlier bronze forms, and thus to popularize them.[2] From this developed the clear and coloured lead glazes which we find upon some of the T'ang dynasty tomb figurines.

These lead, borax, or soda glazes thus seem to have originated in the Near East and not in China. It is probable that their discovery was due to the observation of the fluxing of sand and borax in connection with metal work in early Egypt, at least 7,500 years ago.

The stages between these soft glazes, melting between 750° and 1000° C., and the earliest examples of Chinese translucent porcelain, not later than A.D. 650, still remain somewhat of a mystery. We in the West were content with low temperature right up to the fifteenth century when the Germans began to make salt-glazed stoneware (Plate 25). However, we can be fairly certain that it was their observation of the glazing effect of *wood ashes* upon the walls of kilns and furnaces which led the Chinese with their great commonsense and adaptability to draw conclusions and see the advantages of a harder and less porous kind of pottery.

According to Hamada, the *earliest stoneware glazes* were brown, and composed of either a single natural stone or clay or a mixture of one or the other of these with a small quantity of

[1] Hamada told me of Chinese documentary records of the advent of this Persian. But in his *Beginnings of Porcelain in China* (Chicago, 1917), Berthold Laufer gives ample evidence of the importation of cakes of glass frit, called *liu li*, from Cambodia, Annam and India, between A.D. 200 and 300. It is recorded that this *liu li* was mixed with carbonate of soda to make the low temperature glaze. It is interesting to note that the same word *liu li* is still used to signify glass in China and a certain blue glaze in Japan.

[2] See Plates 35 and 37.

Stoneware Tea-Bowl by Shoji Hamada, 1938. Admirable form, pattern and colour, executed with complete freedom. This is an example of 'window pattern', the bowl having been dipped sideways in white slip to give a white patch for the painting. The growth of the pattern from the exposed foot of sandy pinkish clay to the thick glaze on the lip may be specially noted.

wood ash.[1] In most Japanese traditional countryside potteries to-day the commonest stoneware glazes are of this variety. At the small town of Mashiko where Hamada has lived and worked for the last fifteen years the local building stone, simply ground and levigated, gives an excellent rust-red glaze (*kaki*). By the addition of 10 per cent. of medium wood ash it becomes the rich black glaze called *tenmoku*.[2]

The earliest Chinese stoneware glazes, of which there are good examples at the Victoria and Albert and British Museums are transparent olive. These I have myself reproduced by mixing a siliceous buff clay with 40 per cent. of oak ash, and I have often observed a similar formation of glaze on saggars and kiln walls, all of which bears out the above theory in regard to the origin of Chinese stoneware glazes.

From this original brown glaze of the later Han period, during the succeeding T'ang era, stoneware glazes developed into two types, a light and a dark, the former made of whitish clays or ground stone combined with wood ashes, and the latter of clays and stones containing a fair proportion of iron, to which their darker colour is due.

In all this early stoneware, of whichever type, iron is the main source of colour, its proportions varying from as little as 1½ per cent. in the lighter celadons to 20 per cent. in the darker glazes. This iron is inherent in one or more of the natural materials as what we call an impurity; and although the production of true porcelain as early as the seventh century would seem to indicate an advanced knowledge of potter's minerals, especially if we consider the struggles of European ceramic chemists such as Böttger and in more recent times Seger, I am inclined to believe as a result of my experience of Eastern crafts and craftsmen that whatever knowledge they had was almost wholly based on un-

[1] Shoji Hamada and Kanjiro Kawai were the first Japanese to investigate scientifically the earlier Chinese glazes and to reproduce them at the Municipal School of Pottery, Kyoto, between 1917 and 1920.

[2] See Plates 41, 46, 49.

written oral tradition, itself the outcome of innumerable first-hand experiments of generations of men living very close to nature and very far from laboratory theory.

My own master, Kenzan, was often quite puzzled by my questions concerning the principles underlying procedure and technique and retreated behind a barrage of frowns, and reluctant replies, such as, 'That is the way my master did it,' 'If you do so and so, as I tell you, the result will be this and that.' He was quite unable to explain the theory of *oxidation* and *reduction*, so that consequently for several years I, as a very amateur chemist, imagined myself to be on the verge of an important scientific discovery in regard to the smoky firing of celadons! On the other hand, some knowledge of the part played by oxidation (or clear burning) and reduction (or smoky firing) is essential to even the most elementary understanding of Oriental glazes. It is less important in Europe because by far the greater number of our wares are fired as a matter of course in a clear burning flame. A familiar example of an oxidizing flame is that of an ordinary oil lamp, in which the supply of oxygen entering through the air-holes is sufficient to allow of more or less complete combustion. If, however, a hand is placed over the air-holes the flame immediately becomes smoky, and the same effect is seen if something is put partly over the chimney. The smoky flame is called a 'reducing' flame.

The effect of these two kinds of flame upon the metallic colouring agents in both clays and glazes is opposite, the clear or oxidized flame causes the oxide of the metal to give the resulting colour, and the smoky or reducing flame causes the metal itself to colour the glaze.[1] In the case of iron and copper the results will be browns and greens under oxidation, and greys and reds under reduction. Iron oxides vary from dark

[1] That is, when subjected to an oxidizing flame the atoms of oxygen remain combined with the metal, but when exposed to a reducing flame they are more strongly attracted by the floating particles of carbon (the smoke resulting from incomplete combustion) and leave the metal to unite with them.

brown to brick red; the metal itself is bluish-grey. Oxidized copper is green, the metal red. And so on with other metals, although some of them do not behave in quite such a simple way.

Without access of air, fuel will not burn. Charcoal and coke are made by cutting off the air supply to a minimum. A choked fire of wood or coal burns badly and smokily. Plenty of air means plenty of oxygen and the conversion of the metallic elements in a clay or glaze to an oxide; on the other hand, a flame without sufficient air supply causes the oxides of metals present to 'reduce' to their pure or approximately pure state. The only other flame used in a pottery kiln is *neutral*, or alternating between the two extremes. All three are of fundamental importance to potters.

The fact that a clay containing iron turns grey when reduced, before the glaze over it has melted, should be borne in mind when considering celadons and Far Eastern porcelain. I believe the Chinese recognize some seventy varieties of *celadon* alone, and they are all more or less dependent upon the percentage of iron in the clay as well as in the glaze for their colour. This family of glazes is usually transparent.

Of course the categories of celadon and other glazes have been made by Chinese literati and collectors, as well as by potters, and consequently fanciful names have come to be given to certain effects, in total ignorance of the real facts. Identical glazes are differently classed not only because of the different kiln effects of oxidation and reduction, but even on the basis of pure accidents of firing. The resulting confusion has sometimes led to prolonged arguments amongst connoisseurs, which afford mere potters considerable amusement.

As it is quite practicable to employ glazes which give satisfactory results whether fired in an oxidizing or a reducing chamber, and as Chinese, Korean and Japanese potters have always done so, the seventy celadons may come down to half the number of actually different glazes.

At what point of time *petun'ze*, that is to say, feldspar, Cornish stone, or china stone, which are our nearest equivalents, was discovered by Chinese potters is unknown, but as early as the seventh century a substance must have been found which could be used as a half melting translucent vehicle in both clay and glaze. Indeed, there are in Japan and China natural feldspathic rocks which alone will make the body of a true porcelain if sufficiently ground and levigated. At all events the subsequent development of Chinese, Korean and Japanese porcelains are all based on such a discovery. For the dark family of stoneware china stone is not so necessary, and I doubt if it was used in either their bodies or glazes until later times. In glazes it gives a slow melting fatness of quality, but it should be noted also that in a porcellaneous body, its effect is to heighten the brilliance of the dark iron colours considerably. This I do not necessarily admire myself and regard the sterner and austerer bodies and glazes as nobler than these suave lustrous effects which appeal to a heightened sophistication.

A reference to the chapter on clay (p. 43) will make still clearer the great significance of the discovery of the *primaries*. It meant knowledge of the source of clays in their *mother-rock*, granite, and the properties under high temperatures of *china clay*, *feldspar*, *Cornish* or *china stone* and related first stage derivatives of granite. Again I must emphasize that this was not scientific knowledge, but the outcome of repeated experiments, and with it the capacity to control and enlarge the range of colour grew. To iron were added copper, cobalt and manganese, besides most of the other oxides used by us. The important thing to remember is that quality is largely dependent upon the presence of naturally combined impurities in the raw materials of glazes. That the potter's attitude to his materials, and, I might add, to the technique, should be as delicate and respectful as a good gardener's to his plants, and that he should work with and not against nature, is no less to be emphasized. Thus when we look at stoneware and porcelain glazes we should

expect the qualities of remelted stones. The character of *English slipware glaze* is that of lead glass tempered with common red clay, and here we may expect warm and homely effects. In *salt-glaze stoneware* we must be prepared for what inevitably takes place, namely, the vaporization of the salt. The chlorine escapes as a gas and the volatilized soda attacks the siliceous particles and forms a glaze which has a texture resembling that of orange peel, and one reason why the old German[1] and Fulham bellarmines are so much pleasanter to both sight and touch than modern ginger beer bottles is because the latter are made of an over-refined siliceous clay with which the salt combines to form a thin dull uniform surface. The very kiln blemishes of the old greybeards are full of interest and character, and the crude but economic method of packing the bottles in contact with one another not only resulted in dents and scars but was also an encouragement to the flames of an open wood firing, i.e. without saggars, to produce mottling and variations of colour which are among the most pleasing features of pottery of this type.

In soft *raku* earthenware, although the flux is lead, the character of the glaze is determined by the boracic frit, for the crystalline opacity of this ingredient clouds and veils the otherwise hard and full bodied colours which lie beneath it in a peculiarly attractive way, and softens the excessive brilliance of the glaze (See Plate 21).

The same is true of Far Eastern enamels into which the same frit also enters. These are generally applied to hard-paste porcelain glazes, so that there is no question of the overglaze melting into the underglaze, as in Chelsea or other soft-paste porcelains.[2] Here again the Chinese make a virtue of necessity and preserve the marks of handcraft not only by showing the technique frankly for what it is, but also by keeping to a limited range of carefully selected colours and true stylization of pattern instead of making the overglaze decoration as much like

[1] See Plate 25.
[2] See Colour Block D.

miniature oil painting as possible. Once when examining some portraits painted in enamels on blue china plaques at the Royal Worcester Works, I was astonished that only a very careful examination revealed them to be miniatures not in oils but in enamels. The skill and technical mastery required can be imagined when we remember not only that potter's raw pigments are quite different in colour before and after firing, but that many of them require quite different temperatures in the muffle. What labour lost for the love of bad art!

Probably the best achievement in the West since the splendid free brushwork in lustres on the early Hispano-Moresque dishes is to be found in the precise copper-plate pot-hooks and flourishes and bandings in plain gold on various nineteenth-century wares. The most charming and gay Chelsea pieces or cottage frivolities in lustred Toby jugs can never be taken as seriously as the best Chinese enamels. I do not mean those late and well-behaved and over-decorated Chinese Court vases of the Ching dynasty but the earlier Ming export wares which can still be found in Japan and the Malay Straits.

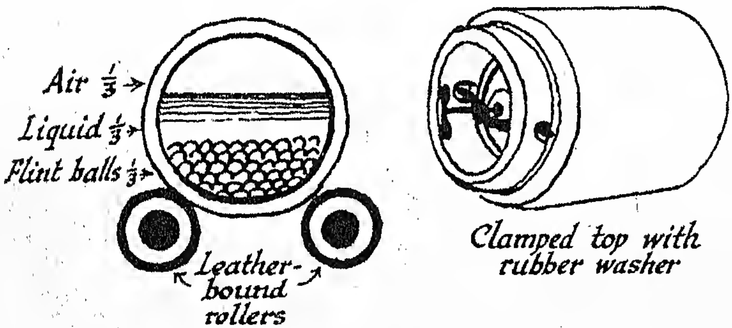
GLAZE-MAKING AND APPLICATION

Glazes are prepared for use either by *sieving* or *grinding* (or both) and mixing with water, and in some cases adding a siccative[1] or a *suspender*, such as a small quantity of ammonia. The thickness of the liquid varies considerably according to the ingredients, as well as with its adaptation to the porosity of the biscuit or raw ware, and the final result aimed at. The degree of fineness of the particles is also determined by the effect required. In stoneware glazes, for example, it is sometimes advisable to retain coarser grains of ash to obtain variation of colour. But, generally speaking, sieves of between 100- and 200-mesh, i.e. with 100 to 200 holes to the straight inch in the bronze lawn,

[1] See p. 151.

will suffice. It is better to have the different ingredients sieved separately, and when possible kept in stock dry, because if they are sieved together it is almost impossible to tell which of them fail to pass through the meshes and therefore difficult to compensate for their loss. Both for effective action and to preserve them from injury sieves ought not to be shaken or jogged vertically, but horizontally, as the vertical motion is apt to damage the lawn. The quickest way to go about it is to let a thin stream of water play fairly hard on the glaze materials and to tap the wooden side of the sieve with a padded bat; the mixture can be allowed to remain in the tub overnight and surplus water siphoned off next day.[1]

Some glazes require to be ground finer than others and this should be done in pot mills, but small quantities can be pre-



Ball mill

pared with a flat glass pestle on a ground glass slab, or more laboriously for larger quantities in an ordinary porcelain mortar.

The prepared glazes should be kept in *hard-wood barrels* of convenient size. I have found it economical to use old beer or

[1] The simplest way to do this is to fill a short length of rubber pipe with water, pinch both ends tight and place one in the liquid to the required depth, the other end must then be suspended over the edge of the tub and when it is at a lower level than the first it may be released.

cyder barrels called 'stinkers', which are usually obtainable from a brewery or cyder-mill at the modest cost of 5s. each for the nine imperial gallon, or firkin, size. The glaze barrels should be provided with wooden covers to keep out dust, etc., and should also be carefully marked with oil paint. The hoops can be painted to prevent rust and breakage. Nothing is more vexatious than to discover a tub of glaze or pigment which has not been used for some time and to be unable to know what it is because someone has neglected to label it.

A very useful and simple tool for keeping glazes from settling as they are being used is here illustrated. The right consistency can be recorded by a *gauge*. Glazes and slips contain roughly 50 per cent. of water, whereas clay ready for throwing has about 30 per cent. of free water in it.

There are several methods of *applying glazes*. The oldest in England is undoubtedly that of the medieval and monastic potters of putting fine dry lead ore (galena) into a bag of loosely woven stuff and *dusting* the half dry clay shapes with it. This would account for the thin patches.

Skill and care are required in the *glazing* of raw wares lest the glaze, which is usually composed of non-contracting materials, should scale off when the pot shrinks in drying, or handles and spouts come off as a result of the resoftening due to the absorption of too much water from the glaze. If these troubles can be obviated by the addition to the glaze of plastic,

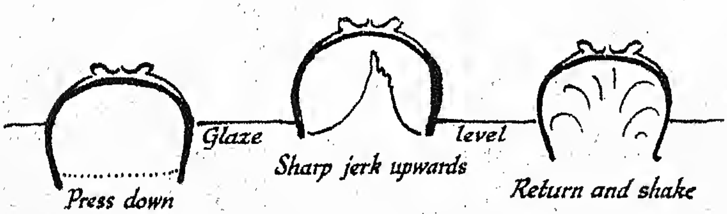
Japanese glaze mixer

contracting clay, thus turning the glaze into a *slip glaze*, the gain in time and money through the consequent avoidance of biscuit firing is a great advantage. Moreover, there are certain decorative processes which can only be used with *raw glazes*. I refer in particular to the dignified practice of graving and cutting away the black lustrous *tenmoku* of the Chinese potters of the T'ang and Sung eras.[1]

With sandy bodies it is generally better to allow a short interval to pass between glazing the inside and the outside of raw pots in order to give the water a little chance to dry out, otherwise the over-softened pot may collapse. When, on the other hand, the clay of which a slipware pot is made is close textured and leathery it is best to glaze inside and out at once.

It is advisable to wet *thin handles* with water a minute or two before dipping or otherwise there is a danger of their cracking under the pressure of the sudden expansion caused by absorbing moisture, or a handle can be covered with damp rags while the rest of the pot gets dry enough for glazing. In any case their natural tendency is to dry before the rest of the pot. Some clays will stand immersion in a glaze when they are quite dry, and this is particularly true of hard porcelain bodies.

Glazes are applied by *dipping*, *double dipping*, *pouring*, *spraying*, *painting*, *dripping*, *splashing* and *trailing*. For each



Double dipping

of these methods there is an appropriate technique which can be properly acquired only by observation and practice. I use double dipping whenever I can grip the pot by the foot suffi-

[1] See Plate 49.

ciently firmly. The drawing on page 145 will show how it is done better than words. By this method, which is much used in the Far East, the inside and outside of a pot are glazed with one movement. I possess a raw-glazed Sung pot with the finger marks of the old Chinese potter still showing in the glaze where he gripped it with three fingers and thumb in dipping.

Single dipping of biscuit is easier: First the interior is swilled out with glaze and the edge wiped clean, and then the pot is gripped by the foot and immersed to the level which the potter thinks suitable. He usually holds the reversed pot at an angle after taking it out of the glaze tub, so that the excess of glaze drips off neatly at the lowest point back into the tub; the last congealing drop he wipes away. Sometimes the whole wet lip is lightly touched down on a wet cotton pad.

Eastern potters either from speed or preference, or both combined, are in the habit of leaving uncorrected *irregularities* which are pleasantly characteristic of the dipping process. Their eyes are more open to the aesthetic value of unpremeditated but decorative effects, such as a happy irregular dip line on a Japanese tea-bowl, or a trail of thicker glaze on one side just stopping short of the foot in a heavy drop. In the East itself this taking advantage of accidents, especially amongst the later followers of the cult of Tea in Japan often becomes an affectation, but this can rarely be said either of the Chinese or the Koreans, of whom the former at least were so firmly tied to the realities of life that they had little time for aestheticizing and were never divorced from the strong national current of unconscious art.

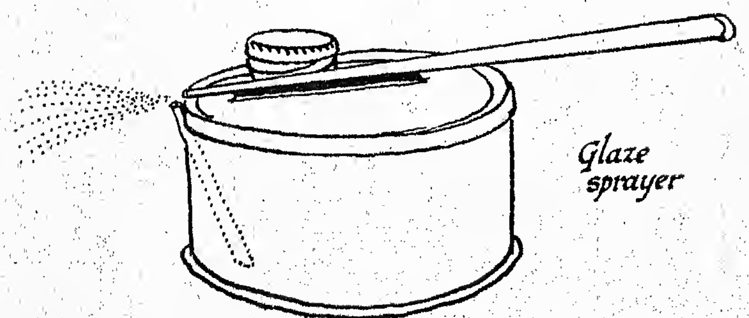
If the pot is to be entirely covered and the foot needs cleaning off afterwards, this is best done with a wet cloth or sponge at once. With raw pots the reverse holds true because of the difficulty of handling the resoftened clay. When the glaze is quite dry it can be removed with an old toothbrush. A further method of preventing the glaze from adhering is to paint the part in question with wax resist. *Awkward shapes* which offer the hand

no convenient grip are best treated in this way, more particularly when they are to be covered with thick stoneware glazes. With thin glazes pots may be fully immersed and the finger marks rapidly touched up before the surface dries.

If the first coat of glaze on a biscuited pot is too thin it is best to re-dip it as soon as the surface has gone matt, later application of a fresh coat tends to scale off. Another glaze can be put over the first in this way, partially or completely; and patterns can be scratched through, exposing the underglaze. Or one glaze can be trailed over another with the same instrument that is used in slip trailing. When glazes are brushed, or splashed, poured, spattered, or sprayed on after a first dipping, it is safer to mix some siccative with them. Such methods are more suitable for slow melting glazes, rather than for quick melting lead glazes. Pouring speaks for itself and applies mainly to large pots and others that are awkward to dip.

Underglaze decoration generally requires an even thickness of glaze over it, and any irregularities should be shaved down with a blade and gently rubbed smooth. *Pin-holes* in the glaze should also be stopped up. Again, most glazes have to be constantly stirred whilst in use, as certain of their heavier elements, such as silica, tend to settle very rapidly. If this trouble becomes serious a glaze suspender should be added to the mixture.

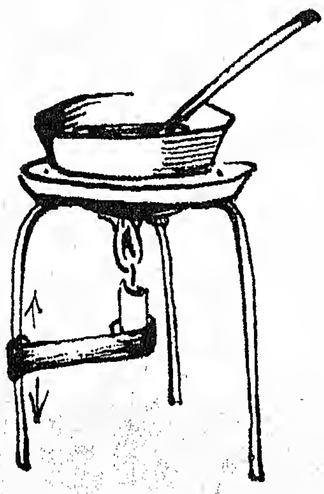
The spraying process is largely used in commercial potteries, but in spite of its ease of application it is too mechanical in its



Glaze sprayer

effects and it cannot be recommended to handcraftsmen, except for applying a tinge of colour to the side or shoulder of a pot or in order to use up a batch of glaze too small for dipping.

Another method of decoration is the use of *paper stencils* between glazes.[1] A simple pattern is cut through, say, a dozen folded sheets of thin absorbent paper (Japanese paper is particularly good for the purpose), and one or more of these are applied to the first coat of glaze with a wet brush and then the pot is re-dipped. Presently the paper can be removed from the pot together with the superimposed glaze that covers it, exposing the underglaze in a neat flat pattern. On raw ware sgraffito lines or decoration can be added.



Method of heating wax for resist painting

Another and similar process is that of *wax resist*. Here, instead of paper, hot liquid paraffin wax (candle) may be used freely with a brush, either on the raw or biscuited body, or over a first glaze. The wax is best thinned with paraffin oil (wax 3 parts, oil 1 part), as this enables one to paint on glaze or on raw clay, to which the plain melted wax will not adhere. When the pot is dipped, or re-dipped, the glaze runs off the waxed surface as it dries. This is a delightful method for free brushwork much used by Shoji Hamada.[2]

Naturally, all these devices can be put to good or bad use; nothing that I can say will ensure the former, but at least the

[1] See Chap. VIII, p. 229.
[2] See Plate 58.

need for restraint and for under- in preference to over-statement may be emphasized.

LEAD AND BORAX GLAZES

At this point I should advise students who want to make practical use of this book to turn to the list of raw materials on p. 260 and refresh their memories about them and their characteristics under heat.

The clear *raku glaze* handed down from the original Ogata Kenzan to my master was composed of:

White lead	61	
Frit	18	
Impure silica (*Boshu Zuna*, a buff coloured siliceous sand from the Boshu Peninsula)	21	Maturing temperature, oxidized, 750° C. Dry weights.

The *lead* by itself will not form a glaze but causes both glaze and pigments to flow, if in excess. The *frit* alone will yield a thick milky glaze. The *silica* by itself does not melt, but in combination with the lead turns into a lustrous translucent glaze.

It will be readily understood that the percentages of these ingredients can be considerably varied according to taste within their natural limits of fusibility one with another. What these limits are cannot be simply stated, and the student must be prepared to learn to know his material through experience and to make repeated trials in order to gain freedom within the range of practicability. He needs to be systematic in this, and my advice to him is always to record such glaze experiments in *percentages* and to combine his ingredients by *dry weight*. When I began collecting old recipes in Japan I was constantly baffled by the fact that some measures were wet, so many

bucketfuls of slip to such and such a dry weight of something else. The potters who wrote them knew what they meant, but their formulae were only of general use to me because I could not do more than guess roughly the water content of their slips, etc. Again, it was some time before I realized the importance of converting their totals to percentages, in order to find a means of relating one glaze or one experiment to the others.

In adapting Kenzan's raku glaze to English requirements I have found it possible to use *red lead* and *litharge* instead of *white lead*. The red lead is rather more fusible than the other forms.[1]

The composition of a *raku glaze* which I used for some time here in England as a substitute for the Japanese was:

White lead	66
Quartz	30
China clay	4

In place of quartz, ground freshwater *builder's sand*, not too red, can be used to obtain variety.

I have also varied this recipe by substituting for some of the lead 10 per cent. to 20 per cent. of finely crushed and well ground flint glass or an English lead and borax frit melting at 900° C.

The china clay gives opacity but insufficient bulk.

These glaze ingredients should all pass through a sieve of 150-mesh, and the frit and quartz should be thoroughly ground.

Kenzan made a transparent *bright apple green glaze* by adding to the ordinary glaze 16 per cent. of well washed and ground copper carbonate. Low temperature green glazes, however, should be used with great discretion, for it is only too easy

[1] The danger of *lead poisoning* from the occasional use of a lead glaze, particularly by the dipping process, is very slight. I have never heard of a case except in factories, where the lead is in continual use and in a powder form is breathed into the lungs. Reasonable precautions should be observed, however, hands and utensils kept washed, and the use of acids such as vinegar in underfired raku bowls avoided.

to produce a hard glaring colour and then to try to reconcile oneself to it by calling it a 'gay note'.

Other *coloured raku glazes* can easily be made by adding to the basic glaze iron, cobalt, manganese or antimony in one form or another to produce browns, blues, purples and yellows. Up to about 10 per cent. of oxide may be introduced without metallic quality predominating. The glazes should be diluted with water to the consistency of thin cream, and for every 20 cupfuls or so of this mixture one cupful of siccative should be added to prevent the glaze from scaling off when the pot is subjected to the sudden heat of a raku firing.

SICCATIVES AND SUSPENDERS

The Japanese use a *dried seaweed*, called funori, stewed for a few minutes in water and sieved, yielding a syrup of the consistency of that found in a tin of preserved peaches. We can obtain a substitute from *Irish moss*, *gum tragacanth*, or even *common size*.

Raku glazes are unpleasantly thin and hard unless they are used generously and applied moderately thickly, and for this reason also it is not necessary to wipe or scrape off trails of doubly run glaze.

Crackle or *crazing* in a raku glaze is unavoidable, and is an important element of the character and beauty of the ware. But because of this, as well as the soft firing of the body, raku must be frankly regarded as porous. This defect can be to some extent neutralized and at the same time the beauty of the crackle enhanced by soaking the finished pots in strong tea. This procedure, repeated several times if necessary, tends to close the pores in an unobjectionable way. Crackle can be brought out still more strongly by rubbing in a colouring matter such as raw umber and a little sweet oil, whilst the pot is still hot from the kiln. Formerly I used to do this, after the manner

of the Chinese, but latterly I have come to feel that such artificial effects are best avoided; they smack of trickery, and are never so kind and pleasing as the slower and honester changes of time and use. This is not so much a criticism of the Chinese craftsman as of our studio potter's tendency to obtain effects cheaply or to overstress art for art's sake.

Before leaving the subject of raku glazes I must make special mention of the two types most in favour with the Tea drinkers of Japan, *aka* or red, raku, and *kuro* or black, raku. The former is made very simply by the application of the clear glaze to the usual body which has been basted before biscuiting with raw ochre of the consistency of cream; and the colour is determined, first, by the quality of the ochre, second, by the method of firing, and third, by the thickness of the glaze. A rich salmon colour is considered the most beautiful.[1]

Black raku is quite a different proposition. The glaze is based upon lead and frit and a very ferruginous stone called *Kamogawa ishi* (Kamo river stone), obtained from the bed of the river Kamo, which flows through Kyoto.

The peculiar thing about this ware is the method of its firing. This is done either in a saggar in a *blacksmith's forge*, or in a specially constructed box or muffle built in the side of a stoneware kiln, where it can be easily reduced. The body is made of very refractory material, plastic fireclay, to which at least one-third of grog (screened through sieves of 20- to 30-mesh) has been added, so that the pot can be removed from the heat of 1200° C. or thereabouts with tongs and plunged into a bucket of cold water. If this is not done, or if the water becomes very hot through repeated dippings, the glaze comes out a reddish brown and even a dull vermilion. The tongs leave a scar or impression on the thick soft glaze but this mark is regarded as a virtue so long as it is firm and deft.

The texture of black raku is due in part to the coarseness of the body, in part to the reduction of the thick ferruginous lead

[1] See Plates 13, 14, 15.

glaze. The granular surface is really the re-smoothed or semi-melted craters from which gas has erupted out of the clay, and indicates the need of slowing up the fire, or at least of some oxidation, for a short time before the pot is withdrawn. The same method of smoothing out bubbles in lead glazes caused by temporary reduction should also be borne in mind in firing slipware glazes, particularly those made with galena. The process can be clearly watched through a spy hole.

Oriental enamels are, generally speaking, ordinary (not kuro) raku glaze or flux, with various percentages of colouring oxides added. The proportions of the three glaze elements are varied to suit these: lead to lower the melting point, silica to raise it, and the frit to increase the bulk. The following table not only gives definite compositions of the principal colours used but will also serve as a guide to the limits between which the components may be varied:

JAPANESE OVERGLAZE ENAMELS

700°–800° C. OXIDIZED

Raku glaze as basic flux			
White lead	60	To soften	To this flux 1 per cent. to 10 per cent. of oxides can be added to give colour.
Frit	20	To add bulk and opacity	
Silica (quartz)	20	To harden (beyond about 25%)	

Kozan light green.		*Hamada light green*	*Hamada turquoise green*
Copper carbonate	4½	3	20
White lead	38	58	
Frit	50	18	
Silica (quartz)	7½	21	15
Turquoise frit			65

Grape purple

Chinese cobalt or manganese oxide	8	The oxide content can vary between about 5 per cent. and 12 per cent.
White lead	42	
Frit	42	
Silica (quartz)	8	

Bright iron red

Bright red iron oxide	20 to 25	This enamel is usually purchased from colour merchants. Great attention is given to its quality, which depends upon the preparation and fine grinding of the iron oxide.
White lead	10 ,, 20	
Frit	60 ,, 65	

Yellow

Antimony oxide	8	Red iron oxide and lead chromate also give yellow, the former dull and the latter bright. Hamada advises the use of either up to 5 per cent. in the basic flux above.
White lead	30	
Frit	46	
Silica (quartz)	16	

Black pigment under greens

Manganese oxide	70
Cobalt oxide	10
Silica (quartz)	20

The Japanese frit mentioned throughout called 'shiratama'

White lead	50
Quartz	39
Calcined borax	11

The Turquoise frit mentioned above

White lead	40
Japanese frit	49
Quartz	8
Copper carbonate	3

JAPANESE OVERGLAZE ENAMELS

These enamels are generally to be found on porcelain glazes and bodies, although white or cream coloured stoneware is sometimes used, as for example, Satsuma, Awata and Inuyama. As it is difficult to apply the thick enamels, even if heated, the pots are first lightly coated with a wash of diluted gum arabic or size. When this has dried the design is painted on with thin lines in black pigment and again dried. Over this the other transparent colours, greens, purple, yellow are heavily and loosely brushed. They are also mixed with gum arabic and are in a thick syrupy state. Red can now be painted on thinly, care being taken to see that it does not invade the other colours, by which it would be dissolved. *Gold* and *silver* are added, if required, in a separate firing, usually at a somewhat lower temperature.

The traditional Japanese way is to use impalpable gold and silver dust with which is mixed a small quantity of the wet red pigment to act as an adhesive, just enough to begin to discolour the gold. This gold when it comes out of the kiln looks like yellow ochre until it has been rubbed and burnished with an agate. It is probably easier to apply gold in the European way in the form of liquid gold chloride, but I have not tried this method.

ENGLISH SLIPWARE GLAZES

The lead glazes used in traditional English slipware were made of lead ore (galena) and red clay. I have already referred to the earlier medieval use of dry galena powder on raw pots, but I am now speaking of eighteenth-century practice. The temperature employed varies between 900° C. and 1100° C. and the proportion of dry clay to dry galena was between a quarter and a half. If the clay did not contain enough silica no doubt quartz was added as we have done at St. Ives up to 25 per cent. of the whole. This raw galena glaze was applied to the raw body, and Michael Cardew and the Truro Pottery still do this

in the way that I have described for slip glazes. But we gave it up at St. Ives partly because it was more difficult to manage, partly because our Cornish red clay was so sandy and absorbent that handles and spouts were apt to split when dipped raw, and partly because we wanted to avoid sulphuration and crackle and to obtain a more tractable ware.

Sulphuration leaves the glaze surface looking matt and rough to the touch, yellowish green and non-transparent, and it is caused by the sulphur present in galena (lead sulphide) turning into sulphuric acid which in turn combines with the soluble salts present and forms sulphates. It is for this reason that galena-glazed wares are fired in open up-draught kilns. Muffles and unpierced saggars would prevent sufficient oxygen from reaching the pots. This sulphuration seems more liable to take place if the fuel, kiln or pots are damp and reduction occurs before the glazes melt. To obviate this defect, which is most prevalent in the interior of narrow necked bottles and vases, we abandoned galena in favour of *litharge*, which is a form of lead oxide without sulphur. This furthermore enabled us to fire pots with their lids on without further fear of this trouble, thus saving kiln space. That this technical improvement has meant an appreciable loss of breadth, roughness and natural strength must be admitted. At the same time, it has enabled us to make pots for table use which do not cause continual complaints because they are porous and rough to the touch, or because silver spoons rake and grit to their damage in bowls and in porringers. The change has raised our percentage of sound pots from 70 per cent. to 90 per cent.

The old colour range is from cream to deep brown, obtained either from iron-bearing clay in the glaze or from common red iron oxide. A clear glaze can be made by substituting ball clay and quartz for red clay, and other coloured glazes by adding up to 3 per cent. of cobalt oxide, or up to 10 per cent. of copper oxide and manganese oxide for greens and purple browns. Although I have seen good greens on occasion, particularly

those of the last English peasant potter, Edwin Fishley of Fremmington in North Devon, still I feel strongly that the essential character of English slipware is to be found in these warm and homely colours out of iron. A little modern knowledge so easily runs away with the sense of appropriateness which tradition imposed on the art of the people. It needs a very good artist to exercise equal restraint to-day.

With all galena glazes over biscuit water alone is needed, and I have not found it necessary to do more than pass the materials through a 150-mesh sieve.

Michael Cardew finds that the addition of seaweed (*Carrageen or Irish moss*) is necessary for raw glazing. He says, a small handful simmered for half an hour in a quart of water is enough for a pan of glaze (four gallons). Strain through a 30-mesh sieve, add to the glaze and stir. If the glaze contains much slip it will curdle, and it will become more difficult to judge its proper thickness, but it does prevent scaling. In winter the seaweed keeps its efficacy for about a fortnight or three weeks, but in hot summer weather it loses it in a few days. When seaweed is used the glazing is usually best done when the pots are hard but have not yet changed colour. Raw glazes should never be very thick or they will flake or scale except in the case of those exceptional clays which will stand dipping when bone-dry. Scaled pots can be heated up after firing and given a second coat of glaze and refired. This is hardly any more trouble or expense than biscuit firing, and it combines the advantages of raw glaze and biscuit. The depth and quality of the one, and the gloss of the other.

Pigments were not used with galena, nor in general are they very suitable under glazes which are inclined to flow. Even slips when they are brushed on tend to disintegrate and it is necessary to superimpose several coatings to ensure a flat tone.

Before leaving the subject of English slipware, it may interest some readers to know that there is at least one pottery in Japan

where a kind of slipware is produced, namely the *Fujina Pottery* near Matsue, which belongs to a family named Funaki who have produced a lead-glazed ware for upwards of a hundred years. The present representative, with whom I worked for over a month three years ago, has come into contact with Hamada and through him with our old English tradition, by which he has been strongly influenced; but he has not blindly followed either. His glazes are a modification of stoneware glazes by lead, and they mature between 1150° and 1250° C. The general effect is similar to ours, but harder and rather smoother and more glossy; the pots are strictly non-porous and uncrackled.

The Chinese also still produce a sort of hard galena ware which they export in some quantity down the Malay Straits, chiefly in the form of large oval baths made of fireclay and glazed inside with a sea-green opaque glaze.[1] These pots are vigorously decorated outside with applied clay strips and pats, notched, tooled, cut and combed, and covered with a rather restrained galena glaze which must be fired at 1200° C.

STONEWARE GLAZES

The following recipes and notes give an introduction to the more important types of high temperature glazes which have been gradually evolved by Oriental potters without the aid of chemistry as we understand it. To expect the studio potter to master the scientific theory underlying the use of impure minerals before attempting to compose glazes is fortunately impossible at this stage, since the study of Far Eastern stoneware and porcelain is still in its infancy. Such exact knowledge is indispensable for industrial purposes, but in its complexity often proves a hopeless barrier to the artist and craftsman.

[1] See Plate 52.

Wood Ash

An unusual feature of the majority of these glazes is the presence in them of the ashes of trees, grasses and other plants used principally as fluxing agents. Vegetable ashes contain varying proportions of alkaline fluxes such as potash, lime and magnesia, stabilizers such as silica, alumina and phosphoric acid, besides small quantities of colouring matter such as iron.

The proportion of alumina and silica to alkalies, after the ash has been washed and sieved to get rid of soluble potash, determines the main effect in a glaze, and is the basis upon which I have divided ashes into three categories—hard, medium and soft. But the proportions and the other ingredients vary considerably from ash to ash and yield in stoneware glazes a considerable range of textures and colours which it would be difficult or impossible to obtain in any other way. It should be explained that such an arbitrary division can only be a rough guide, because certain of those elements, such for example as magnesium and silica, combine in definite proportions at the first opportunity in a rising temperature. Such a combination is called a *eutectic,* and only what is left over will harden or soften the glaze. Then again, in the feldspar for example, there are further quantities of alkalies and silica willing and eager to form combinations, so that altogether the explanation of what takes place and the theoretic means to control it is definitely work for the chemist—and complex work at that. Fortunately the practical potter can go ahead with trial-and-error methods of experiment and gradually acquire a working knowledge of the properties of his raw materials.

Amongst the substances present in most of these ashes, alumina does not lend itself to these combinations; therefore its action is proportionately powerful. On the other side, magnesia forms a viscous flux with silica with a long range of vitrification.

Silica of vegetable origin differs from quartz or flint in so far as its intimate combination with the fluxes causes it to melt

more readily, although in highly siliceous ash it remains suspended as a crystalline opacifier.

In general, *bark* and *twigs* yield the best ash, and the maturer the growth the greater the proportion of silica is found to be. Straw, grasses, reeds and ferns may vary as much as 15 per cent. between spring and late autumn cutting. The soil, moreover, upon which the plant grows affects the composition of the ash, so that it is advisable to gather a considerable quantity at a time and mix it after burning in order to make several batches of glaze of identical character.

In Japan it is customary to burn the fuel to an ash in an open bonfire on a clean surface such as gravel or fireclay bricks. The important thing is to avoid the admixture of iron-bearing earth or clay. It is wise to choose a day when there is no wind and not to make a great blaze which would carry off the light ash and reduce the quantity of the remainder by burning it white. Most ashes are grey or buff, but those which I classify as hard generally burn black. After burning the procedure is to mix the ash with plenty of water in a receptacle and remove the charcoal and scum which rises to the surface with a coarse sieve. Then the mixture is promptly decanted, leaving any grit or sand at the bottom of the first receptacle. The next procedure is to run the liquid through a 60- to 100-mesh sieve and preserve what will not pass through it, together with the coarser charcoal, for drying and further burning. Finally the ash is passed through 100- to 200-mesh, according to the requirement of the glaze. The residue can generally be coaxed through the finer sieve by a gentle rotary action of a nail brush. After the ash has settled for a few hours the brackish surface water containing the greater part of the soluble alkalies is poured off. Fresh water is added and the decanting repeated until the water is clear and tasteless.

The ash is then dried and stored. A study of the following tables of analyses of vegetable ashes made at the Dartington Hall Laboratories in 1938–39 may serve to give a general idea of the part played by those substances in Oriental glazes.

VEGETABLE ASHES

The figures in the columns marked 'hard, medium, soft' have been arrived at by adding the silica, alumina and phosphorus contents together on the one hand, and the fluxing agents, lime, potash and magnesia on the other, and subtracting to give a residue roughly suggesting the effect of the ash in a glaze. Medium ashes are those which lie between 40 hard and minus 20 soft.

In Japan the ash of the *isu tree* is universally regarded as best for porcelain glazes. The *mixed autumn weed ash* is not dependable because it is next to impossible to determine the proportions of the various plants contained in it, but it is interesting to observe that in this case and with bracken there is practically no loss by washing. It may be noted that *bracken* contains an unusual amount of magnesia, and *apple pulp* of alumina and phosphorus. The contrast between *apple wood* and apple pulp is marked and indicates the degree of care which should be taken to obtain the same material from year to year.

Sulphates, *chlorides* and *soluble potash* are eliminated principally by the first washing. The *carbonates* are in combination with other ingredients such as lime until they are released as carbon monoxide gas at a temperature of about 900° C., and allowance has been made for them in the percentages given in the table. *Sodium* has not been determined, but is present in traces as are also *manganese*, *boron*, *copper*, etc.

Wheat straw makes a hard ash, *barley straw*, *oak* and *elm* are medium, and *bean straw* and *clover* soft. Wheat husk is close to rice straw in analysis and therefore very hard.

The Effects of Different Wood-ashes on Glazes

Miss Katharine Pleydell-Bouverie, who during the last ten years has been using various sorts of wood-ashes in her stone-

Description	Silica	Alumina	Phosphorus	Iron	Lime	Potash	Magnesia	Carbonate	Sulphate	Chloride	Hard	Medium	Soft
Japanese rice straw ash, fully washed	77·68	9·11	0·90	2·93	4·00	1·68	2·44	0·96	—	—	79		
Japanese isu ash, fully washed	71·96	0·63	0·42	0·28	15·95	0·84	1·57	8·29	—	—	54		
Thatching reed ash, fully washed	51·10	12·90	6·28	2·42	13·15	3·12	4·41	6·47	—	—	49		
Mixed autumn weed ash, unwashed	56·45	4·31	2·57	1·17	18·10	2·73	5·32	8·11	1·05	0·06		37	
Ditto., fully washed	57·47	4·26	2·15	1·18	18·81	1·66	6·05	8·29	—	—		37	
Apple pulp ash, once washed	33	22	13·42	1·53	11·15	9·26	4·56	5·46	—	—	43		
Ditto., unwashed	27·76	21·48	11·14	1·18	6·95	15·50	6·43	5·59	3·21	0·10		31	
Lawn mowings ash, once washed	39·64	16·60	9·00	3·44	12·88	6·19	5·65	6·20	—	—	40		
Ditto., unwashed	30·16	12·43	7·90	2·37	7·83	17·55	5·39	7·58	3·50	4·94		19	
Bracken ash, fully washed	40·37	11·97	4·43	0·72	20·61	2·35	10·90	8·26	0·23	0·16		22	
Ditto., once washed	40·59	9·42	3·98	0·82	20·38	3·40	10·55	9·33	0·82	0·71		19	
Box ash, fully washed	14·29	10·34	4·73	2·74	37·55	2·58	6·12	21·49	—	—		−17	
Apple wood ash, once washed	2·65	1·98	1·59	0·70	54·20	0·89	3·25	34·69	—	—			−52

ware glazes at Coleshill, divides them into five groups according to colour and quality. The glazes are all made in the same formula, *one part of ash, one part of feldspar and half a part of Pike's clay*,[1] or with such slight differences that neither the colour nor the quality is affected. Lawn of 120-mesh was employed throughout for sieving.

A. Oak, beach, elm, thorn, box, hornbeam, holly, laurustinus, rose. These tend to produce a fat, smooth glaze, pale bluish or greenish in colour and usually heavily crackled.

B. Spruce, maple, lime, ivy, ash, elder, larch, laburnum, horse-chestnut. These produce a matt surface, varying in colour between a creamish grey and greyish blue and usually uncrackled.

C. Yew, walnut, cedar. Very matt, almost rough; greyish in colour or almost white in the case of walnut.

D. Scotch pine, peat, black currant. Oily texture, greyish or olive, rather darker than the others.

E. Grass, reeds, nettles, lavender. White or very pale grey, rather sugary in texture and heavily crackled if used thick.

As we should expect, however the glazes are apt to vary, not only according to temperature but as a result of fortuitous differences in the kiln atmosphere, such, for example, as may be caused by the use of different sorts of wood fuel, especially in finishing. As Miss Pleydell-Bouverie points out, one is very apt to take things for granted and to make up one's mind that some result is the effect of a given cause, and then after years even to obtain a totally different result, and finally realize that it was due after all to a factor that had hitherto been entirely unnoticed. Whether the things that happen in one kiln would be repeated in any other kiln—how much damp fuel or kilns, humidity in the atmosphere, wind, length and diameter of chimneys, packing, stoking, etc., have to do with results ascribed to variations in wood fuel, is also a question which can only be answered on the spot by an experienced potter.

[1] See pp. 60 and 61.

The effect of different kinds of wood for glost firing has been very little investigated, but Miss Bouverie's experience goes to show that certain woods such as elder, ash, oak and elm cause more reduction, and others like horse-chestnut, apple and walnut tend to oxidize. In some cases the appearance of the flames is deceptive, thorn makes very little smoke and yet reduces, and spruce makes a great deal even when the atmosphere is predominatingly oxidizing. As one might expect from the analyses of ashes moreover, the composition of the burning gases is altered in other ways according to the wood used.

Acid fumes (such as sulphuric) may be liberated which under oxidizing conditions combine with any lime present in the clay and cause spots or scum, or *alkaline salts* may form silicates with the body covering the exposed ware with a thin coating of salt-glaze.[1] If the temperature is not high the *sulphates*[2] may remain suspended in the glaze as opaque whitish spots. Soluble salts in the clay may be dissolved by water or even humidity in the atmosphere if the ware is porous and appear on the surface as an efflorescence months after the firing. Such effects can often be seen on common red bricks, but may be eliminated by the use of carbonate of baryta in the clay mixture.

The stoneware glazes with which I am familiar may be divided into four different groups: celadons, iron glazes, uncoloured and coloured glazes.

CELADONS

Turning first to the celadons, which form a large family of greyish green or blue, transparent or semi-opaque, crackled or uncrackled glazes. They all owe their colour to the presence of between 1 per cent. and 3 per cent. of iron, ferric oxide giving the yellower and ferrous the bluer tones in a reducing atmosphere.

[1] See p. 203. [2] See p. 156.

Modern potters use chemically purified oxides, but it is still feasible to employ natural clays such as ochre or china clay, or rocks like feldspar or Cornish stone, containing the requisite quantity of oxides in the Oriental way. More beautiful textures and colours can often be obtained from materials finely subdivided and intermingled through long periods of geologic time. Characteristics which these glazes have in common are a high percentage of feldspar and to a less extent of silica. Hamada gives a proportion of *limestone* 1, *quartz* 2, and *feldspar* 3, as a sound basis for experiments. At temperatures between cones 7 and 9 feldspar adds body and some opacity to glazes which are usually applied thickly, and silica tends to reduce crackle and prevent flowing if the amount exceeds the eutectic[1] demand of the fluxing agents and therefore remains free. A curious and unexplained fact about fluxing agents is that two in combination will act more powerfully than either alone.

Resistance to heat, and opacity, may be increased by the addition of clay, especially china clay, which remains suspended in tiny particles, but a large proportion will take away from clarity of colour, especially if it should contain manganese.

The quality of a celadon glaze depends to a great extent upon grinding and upon the character of the silica. Water-ground flint and quartz as supplied to the trade often require additional grinding in a pot-mill. In Japan fine celadons are frequently ground for forty hours.

[1] See p. 159.

CELADONS

Name	*Composition*		*Oxidized*	*Reduced*	*Maturing Cone*	*Notes*
Leach's Korean type	Feldspar Limestone China clay Pike's clay Quartz Calcined ochre Red iron oxide	25 25 6½ 20 20 2 1½	Amber	Quiet grey-green	7–9	These two recipes, arrived at independently, have the same proportion of feldspar. The ash is equivalent to the limestone, the combined clays in mine are less opacifying than the 25% of China clay in Kawai's. The silica in his reed ash is more opalescent than the quartz in mine, but there is a strong similarity. Mine can be applied raw to short bodies.
Kawai's Korean type	Feldspar Medium ash Reed ash [1] China clay Ferrous oxide	25 32 17 25 1½	Amber	Quiet grey-green	7–10	
Kenzan Celadon	Feldspar Medium ash China clay Quartz Calcined ochre Red iron oxide	62 18 12 2 6 ·12	Amber	Transparent olive green	7–9	The ochre, iron, quartz and any coarse ash should be ground in a pot-mill, the alternative is an opaque mottled effect beautiful in itself.

Kawai's Celadon	Feldspar Limestone China clay Quartz Iron oxide	61·3 7·5 4·9 24·8 1·5	Amber	Green or bluish green	6–8	This composition gives a bluish colour with black iron, FE_3O_4 and a yellower green with red, FE_2O_3. 2% of Barium carbonate may be added to clarify the former. Use thickly.
Hamada's Lung Ch'uan Celadon	Feldspar Pine ash Calcined ochre	64 27 9	Amber	Heavy dull green. Bottle green when hard fired	6–8	Pine makes a strong flux. Grind the ochre well. The old Swankalok celadons were of this type.
Kawai's Lung Ch'uan Celadon	Feldspar Limestone Quartz Red iron oxide	78 6 14 2	Amber	Heavy dull green. Bottle green when hard fired	8–10	A harder and more reserved glaze.

[1] In Japan rice straw ash.

IRON GLAZES

The chief point to be noted in regard to the three iron glazes called by the Japanese, *kaki*, *tessha* and *tenmoku*, is their close relationship. Whether in the form of natural earths or stones, or artificially made up, most kaki and tessha glazes can be turned into tenmokus by the addition of 5 per cent. to 10 per cent. of limestone or wood ash. In other words, they only need a little additional flux to subdue metallic effects produced by oxidation upon the glaze surfaces. The transmutations of iron upon which these glazes are based may be occasionally observed where iron pigment emerges through a feldspathic alkaline glaze from its dark brown reserve through tessha mutations to kaki and even more open metallic exposure. A high percentage of feldspar assists the formation of a good quality kaki, but too much silica gives a hard metallic surface. Silica of vegetable origin is for this cause better than flint or quartz. Quick cooling causes rougher segregation of iron crystallizations, therefore for tea-dust, tessha and tenmoku oil spot effects it is very important. Opaque iron colours are sometimes due to calcium crystallization when either limestone or wood ashes predominate. The chemical composition of one of the natural rocks used in Japan, for kaki, is as follows:

Kimaichi stone	Silica	61	When ground ready for use it has the appearance of Portland cement.
	Alumina	21	
	Iron	5	
	Manganese	0·25	
	Limestone	6	
	Magnesia	0·22	
	Kalium soda	6	

In the following recipes Cornish stone may be used in place of feldspar. It causes a glaze to settle more readily, but otherwise we have not discovered an appreciable difference.

For silica we have employed Wenger's water-ground quartz.

The Pike clay constantly mentioned is siliceous white ball clay, G.F.S. marketed by Pike Bros., Wareham, Dorset.

IRON GLAZES

Name	*Composition*			*Oxidized*	*Reduced*	*Maturing Cone*	*Notes*
Tea-dust	Raw ochre Medium ash		50 50	Frosted opaque olive green	Greener	8	This is an example of opacity due to ash crystallization.
Kaki	Feldspar Medium ash Quartz Red iron oxide Reed ash Ochre	30 20 25 25	43 30 10 17	Opaque rust red	Brown to black	8–11	Needs high temperatures and oxidation. Underfires olive to dark brown.
Hamada Kaki	Feldspar Medium ash Reed ash Red iron oxide		33 33 25 9	Opaque rust red	Brown to black	8–11	Reed ash supplies the silica.
Hamada Tessha	Cone 8 glaze Quartz Red iron oxide		61 26 13	Variegated iron brown	Brown to black	8–11	An intermediate glaze between tenmoku and kaki.

Hamada Tenmoku	Cone 8 glaze Medium ash Quartz Red iron oxide		56 8 24 12	Heavy brown to black	Colder	8–10	Change of colour due to added flux. When high fired thin surfaces turn to kaki.
Kawai Kaki	Cone 8 glaze Quartz Red iron oxide		75 14 11	Opaque red rust	Brown to black	8–11	To obtain a fuller comparison reduce the cone 8 glaze to its components.
Kawai Tenmoku	Cone 8 glaze Quartz Red iron oxide Medium ash	68 12½ 10 9½	62 12 9 17	Heavy brown to black	Colder	8–10	The only difference between these recipes is 10% of ash.
Bouverie Tessha and Kaki	Feldspar Limestone Pike clay Quartz Red iron oxide		21 16 26 26 12	Varie-gated lustrous iron brown	Colder	8–10	To turn this into a kaki glaze 4% of iron is added.

PALE OR COLOURLESS GLAZES

Name	Composition				Oxidized	Reduced	Maturing Seger Cone	Notes
Ordinary Stoneware	Feldspar Medium ash Limestone	70 20 10	70 30	60 30 10	Warm	Cold	8	Colour dependent on iron in body and ash.
Cone 8 Limestone Glaze	China clay Limestone Quartz Feldspar			10 20 30 40	Warm	Cold	8	Standard glaze. Good base for added oxides. Slightly milky.
Bouverie Slip-glaze	Feldspar Ash Pike clay			40 40 20	Warm	Cold	7–10	Colour, quality and temperature dependent upon ash employed and upon the body.
Kawai Semi-matt	Feldspar Limestone China clay			66·4 8 25·6	Warm	Cold	8–10	Rather opaque and reserved.
Porcelain equivalent of Japanese glaze	Feldspar Hard to Medium ash			75 25	Warm	Cold	8–10	Little tendency to crackle. Good with bracken ash.

Greenish Porcelain	Feldspar Bracken ash Limestone China clay Pike clay Quartz Red iron oxide			25 12 15 7 20 20 1	Cream	Greenish white	8	Really a pale celadon. Some porcelain bodies could be dipped in this raw when quite dry.
Chün or Yüan	Feldspar Medium ash Reed ash Limestone	58 21 16 5	55 15 25 5	30 40 30	Semi-opaque cream	Semi-opaque blue, opalescent	8–10	Needs reduction and maximum thickness.
White Matt	Feldspar Bracken ash Pike clay			40 40 20	Reserved opaque white	Snowy grey	7–9	Depends upon quartz and alumina content of bracken. Apply thick over light body or white slip. Oxidize.

COLOURED GLAZES

Name	*Composition*			*Oxidized*	*Reduced*	*Maturing*	*Notes*
Kawai's blue (Ruli)	Feldspar Cone 8 glaze Cobalt nitrate		20 80 0·2	Grey-blue	Blue	8–9	Wash precipitated cobalt nitrate and add iron, clay, or manganese to modify.
Kawai's Yellow	Feldspar Cone 8 glaze Yellow Uranium oxide		20 78 2	Yellow	Grey to black	8–9	Grind oxide, remove scum and sediment. Strict oxidation.
Old Seto Yellow	Feldspar Medium ash Cone 8 glaze Ochre	 40 20 40	25 50 25	Yellow to opaque olive	Olive green	8–10	Oxidize. When thin, yellow. When thick, green. Tea-dust.
Kawai's Transparent Brown	Stoneware glaze Kaki glaze		70 30	Brown	Brown	8–10	At high temperature the body will tend to show rust on thin edges instead of amber or yellow.

			Raw				
Manganese Glaze	Feldspar Medium ash Pike clay Manganese oxide	38 38 19·2 4·8	32 32 32 4	Opaque coffee-brown	Darker	7–9	Suitable for rough bodies. Good over celadon.
Copper Red Glaze	Feldspar Limestone Red lead Quartz Tin oxide Cuprous oxide		55 22 4 14 3 2	Red to purple	Green	8–10	This is an underglaze to be covered by the ordinary stoneware glaze.

CRAZING

Crazing, or crackle as it is called when deliberate, is the result of greater shrinkage in the glaze than in the body either during cooling or subsequently. The theory of crazing in glazes is highly complicated and is still the subject of investigations. Irregular expansions and contractions of both body and glaze take place in a pottery kiln during the rise and fall of temperature, and they are due to a variety of causes. One of the chief of these is the change of quartz and flint at high temperature into *cristobalite*. A characteristic of this form of silica whilst cooling is a sharp contraction at about 225° C. The presence of 5 per cent. to 15 per cent. in a body will produce what is called the 'cristobalite squeeze', which exerts a centripetal compression on a glaze which tends to prevent crazing.

To secure agreement between body and glaze their compositions must be clearly established and tests made. If these show crazing, the alkaline elements in the glazes should be reduced and the siliceous and boracic increased. In the reverse case of scaling, where the centrifugal strain in the glaze causes it to flake off, the opposite processes should be employed. If these modifications are insufficient the body must be altered. Cristobalite may be cheaply obtained as powdered silica-brick waste. *Talc* which is commonly introduced for the same purpose acts as a catalyst and assists the transformation of silica. *Pitchers* (ground fired body) may be employed if for other reasons it is desirable not to alter the composition of the clay.

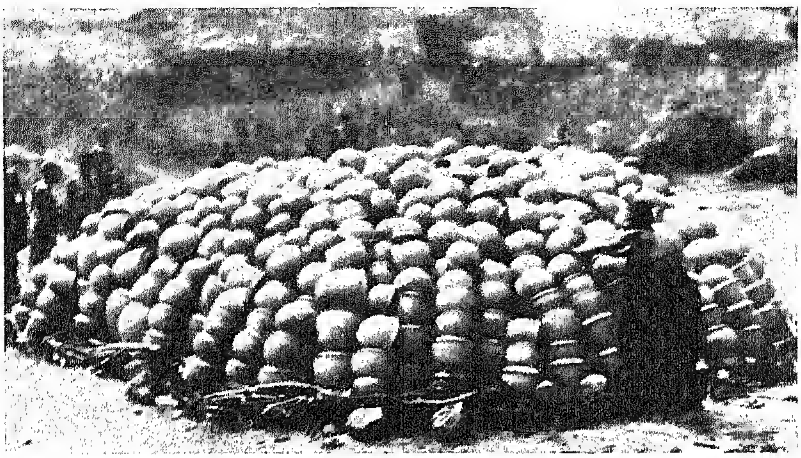
The effect in either case is to give an increased cristobalite content. The addition of *powdered flint* is the usual first alteration to a body to prevent crazing, but more important than an increase in quantity is a decrease in the size of the particles of silica. *Borax* as a fluxing agent has a high coefficient of expansion which reacts against the tendency to craze. Raw borocalcite, B_2O_3, is the best. In glazes which contain frits

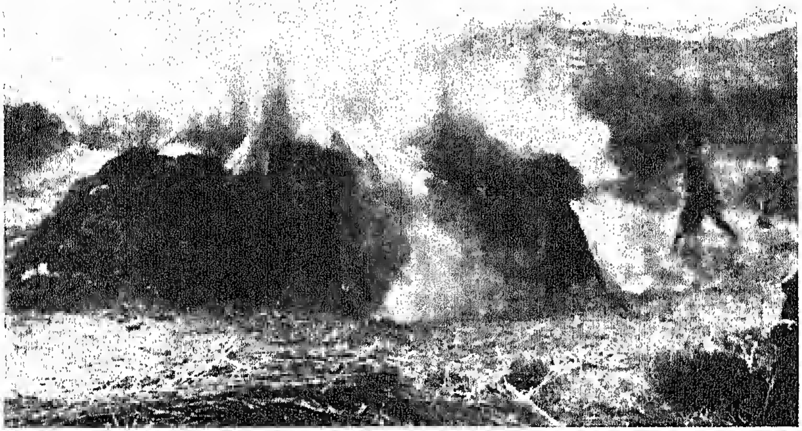
resistance is increased by including a proportion of a very *soft frit*. A method employed in Japan consists in drying, *calcining at* 700° *C.*, and regrinding half of the glaze and then mixing it with the remainder. In *non-vitrified bodies* the amount of the flux should be increased and in *vitrified bodies* the reverse is true. Finally, in bodies which contain *ball clay* and *china clay* the former should be increased and the latter decreased.

Chapter VII

KILNS

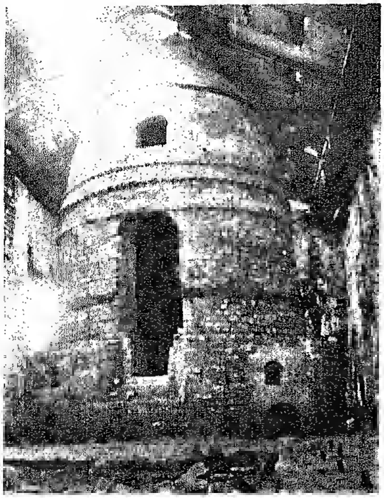
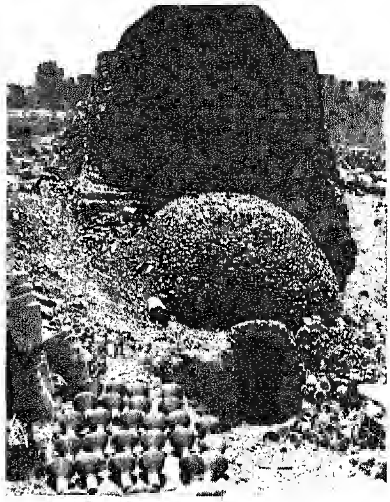
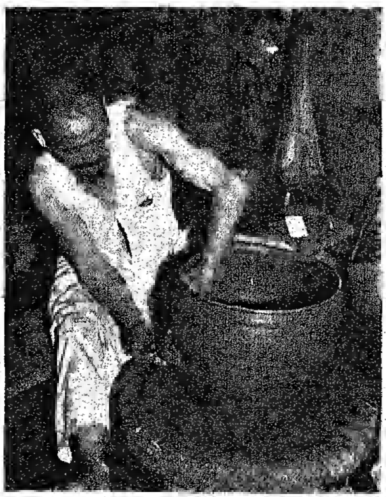
Kilns may be considered simply as chambers fed with flames by one or more fireplaces, and out of which a chimney draws heat and smoke. Or one may think of a kiln, unless it be electric, as a chimney or flue with a swelling near the furnace end, in which the pots gather the passing heat. The pots, or the saggars (fireclay boxes in which the wares are stacked and protected), or the shelving act as radiators, accumulating and reflecting the heat from surface to surface. It is a very efficient kiln which can gather 30 per cent. of the heat generated. Each batch of fuel contributes a little, until the temperature necessary to melt the glaze equally in all parts of the chamber is attained. For this purpose the flames must be distributed evenly, and a general rule holds good that at no part of the chamber may the flame ways be less in total section than the inlet from the furnace or the outlet to the chimney. But, as I have explained more fully in the chapter on glazes, it is not only a given temperature which has to be evenly distributed, but also a predominant *atmosphere*, clear or smoky, upon which the colour and to a large extent the quality of clay, pigment and glaze will depend. The construction of a kiln, as well as the method of stoking it, helps to determine the composition of the burning gases. Many kinds of fuel have been used: grass, woods of different sorts, charcoal, coal, coke, gas, crude oil, paraffin, and electric current. Generally, a long gentle flame, free of impurities such as sulphur, gives the best results. Because of this, light and





72. Nigerian Women Potters piling their raw crocks in preparation for an open firing.

73. Feeding the flames with bundles of dry grass.


74. English Bottle-neck Kiln showing entries, iron bands and chains, and two out of five firemouths.

75. Round Up-draught Kiln at Old Cairo, packed from the fire-mouth, showing the transition to the bottle-neck.

76. A Korean Potter throwing on a Kick Wheel.

77. Mr. Tomimoto throwing on the Japanese Hand Wheel.

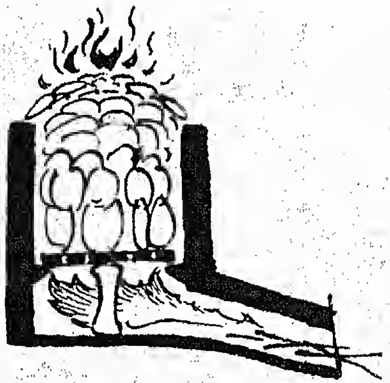
resinous *wood*, despite the labour involved, has many advantages. It is interesting to note that besides having been employed from the very beginning in all the old potteries of the world, including those which produced the most beautiful quality of glaze, wood is still used at Sèvres. The best modern substitutes are *gas* and *oil*. Electricity has hitherto had the disadvantage of limiting the atmosphere to oxidation. But it must not be too readily assumed that exact scientific control necessarily yields the most beautiful results. Quite a large proportion of the most pleasing kiln effects were, in the days of manual labour, due to accidental happenings only partly under the control of the potters. The use of wood in firing has always contributed largely to such effects.

The earliest method of baking unglazed earthenware was in an *open fire*, and is still practised in some parts of the world. The illustration of Nigerian women throwing armfuls of dry grass on a large bonfire, in the heart of which the pots are piled, probably takes us back many thousands of years in the evolution of the craft. The reason that the pots do not dunt or burst when fired in this primitive manner is that they are made of coarse sandy clay, often containing flat particles of mica. Thus, for reasons similar to those which explain the successful firing of Japanese raku, sixty or seventy per cent. survive. The larger pots are given a preliminary heating over embers and small wood for upwards of an hour, then they and the remaining thoroughly dried wares are piled up as high as five feet on a bed of sticks. Broken sherds are used as buttresses, and more sticks are laid against the mass and lighted. The firings are very short, often lasting only an hour or two. As soon as the wood begins to burn away, dry grass is thrown on in armfuls until the pots are covered with a glowing heap of fine embers, which, by preventing draughts of cold air from reaching the pots, is in itself a protection against dunting. The maximum temperature cannot exceed 750°–800° C. At the end of the firing the pots, some red, some black and some mottled, as may be

expected from the varying amount of smoke to which they have been exposed in the uncontrolled atmosphere, are lifted out on poles. Those which are intended for cooking purposes are basted while hot with the juice of certain leaves to close the pores.

Such was the origin of the kiln, and it may be suggested that the rudiments of ceramics could be taught in this way in country schools.[1]

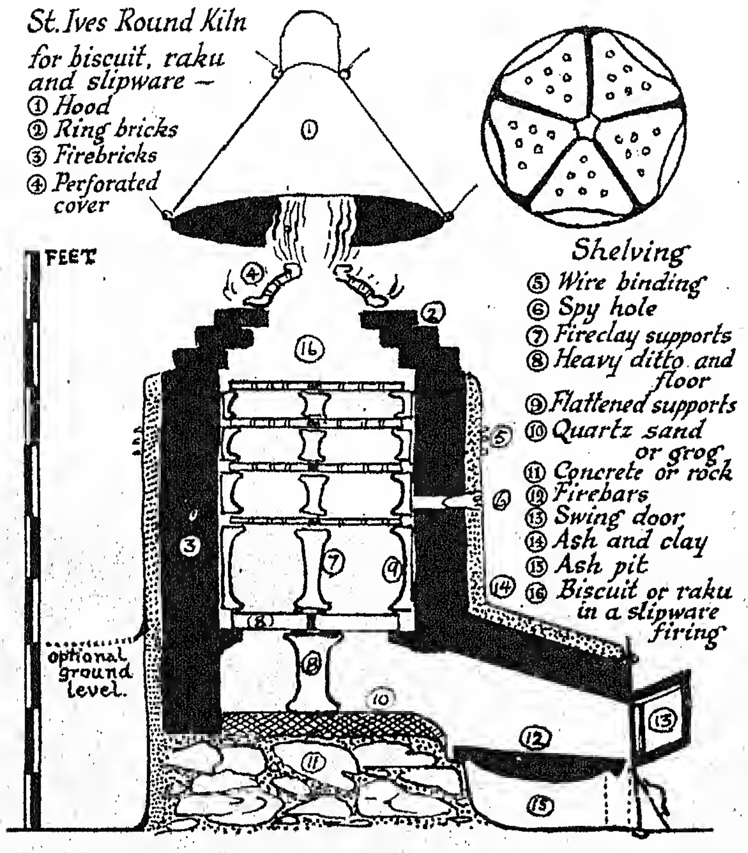
The evolution of kilns must have been governed by the necessity to conserve heat and exclude draughts. This was achieved by banking or walling the pots in, and by introducing the heat through channels or flues. Two types are sufficient to illustrate the development of kilns right up to recent times both in the East and the West, for the great majority of modern kiln designs are merely modifications of one or other of these. The first one I call a *bank*, or climbing kiln, and the other a *bottle* kiln. A British–Roman example of the latter type has recently been set up in the children's educational section of the Science Museum at South Kensington. A covered trench dug in the ground led to a chamber formed by a circular wall. The unglazed pots were packed on a raised perforated floor to the height of the wall and then closed in at the top by loosely overlapping sherds. Wood was burnt in the mouth of the trench and the



Simple round updraught kiln

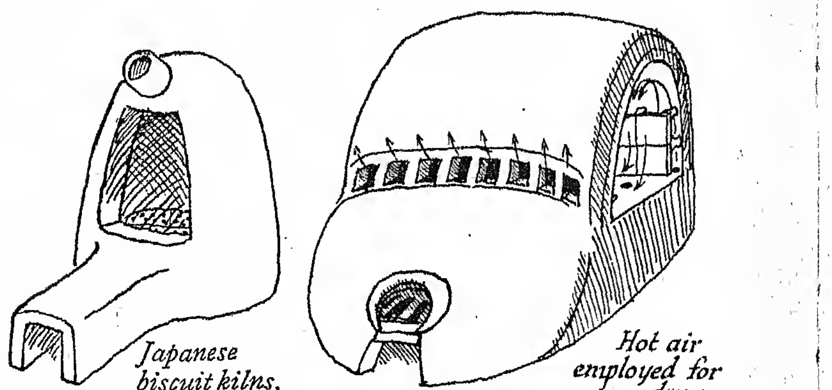
[1] Among unspoiled primitive people in many parts of the world the making of pots was strictly in the hands of women. Men seem to have displaced them at the stage when properly built kilns and wheels began to be used.

flames found their way through the piled up pots and out through the interstices at the top. There was no chimney at this stage.



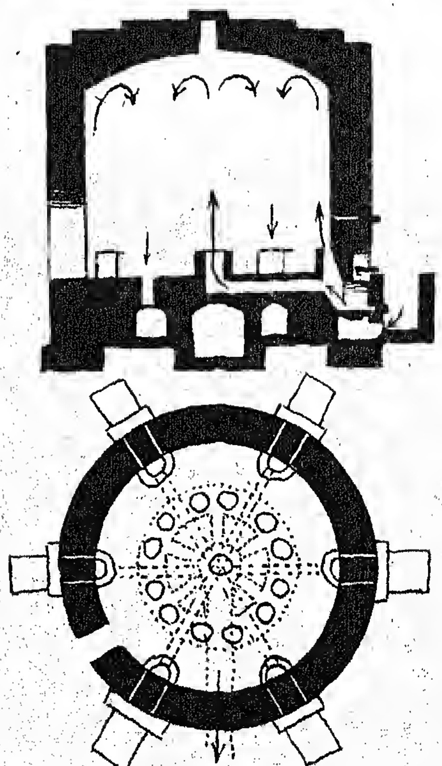
St. Ives round up-draught kiln

This simple type of *up-draught* kiln has been used all over the world. The drawings and Plate 74 show its development into the familiar bottle-neck kilns of the Potteries and its further evolution into *down-draught* kilns. We still use a very similar kiln at St. Ives for all temperatures, although for stone-

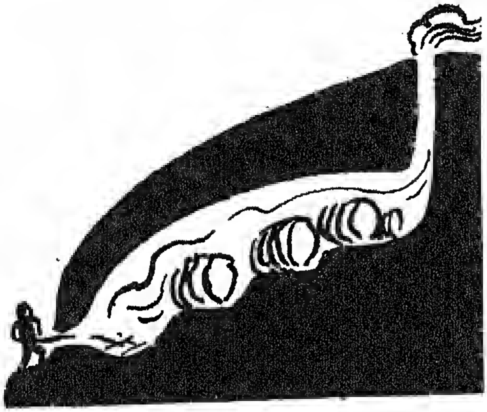


Japanese biscuit kilns, domed up-draught and down-draught

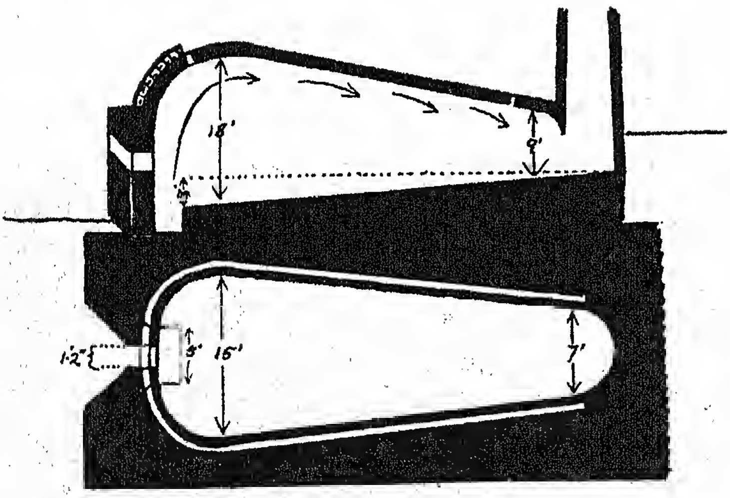
Hot air employed for dryers down-draught



Round down-draught kiln



Oriental bank kiln



Chinese kilns at Ching-te Chen, which the Newcastle and Cassel kilns closely resemble

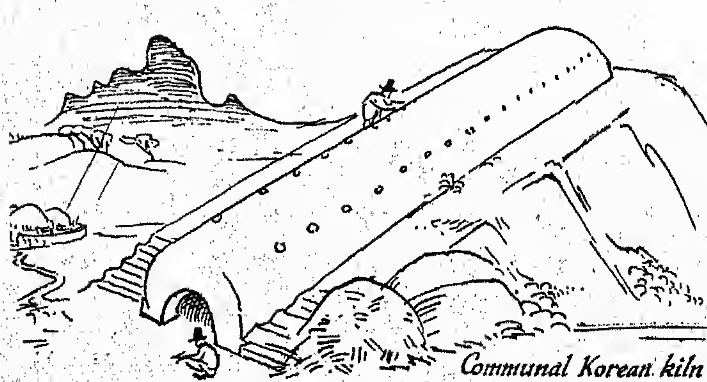
ware and porcelain it is difficult to baffle the rising heat back sufficiently to equalize temperature and atmosphere from top to bottom of the chamber.

The bottle-neck kiln proper is made simply by heightening

the wall and rounding it into a dome with a chimney above it. The packing is done through a doorway which is sealed with firebrick and clay before each firing. In Staffordshire, the kiln itself is often protected from bad weather and draughts by an outer shell of brickwork called a hovel, and between kiln and hovel there is a considerable storage space for saggars and fuel. Over the dome a second chamber is sometimes built which is partly, or wholly, heated by the excess of flame flowing through it from the lower chamber. In down-draught kilns the heat, instead of rising through the dome, descends between the stacks of saggars, below which it is collected in a central flue which leads to a separate chimney. Such kilns conserve heat better and are more suitable for reduced atmospheres.

The bank, or climbing kiln, originated in the Far East: a cave was dug in the sharp fall of an earthy bank, a small doorway was left as a stoke-hole or furnace mouth, and at the opposite end an opening was cut through to the surface as a chimney. The floor was stepped, and the pots were piled on the level terraces, the flame passing around and over them.

The next drawing represents a communal climbing kiln in a potters' village near the capital of Korea. In this case the

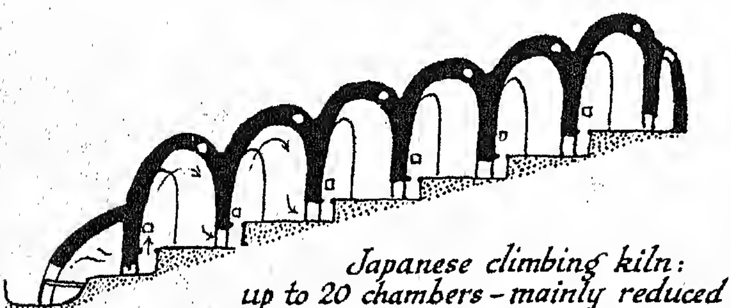


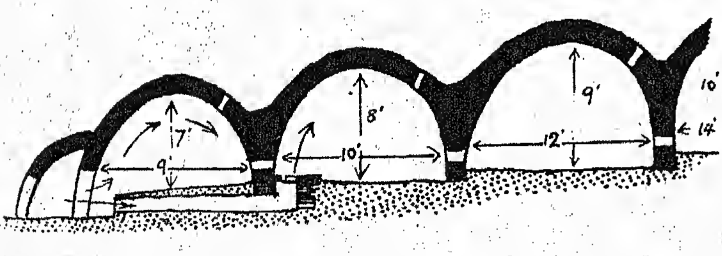
Communal Korean kiln

slope is artificial, and the kiln has developed into a long straight tunnel half closed at the two ends and tilted at an angle of thirty

degrees. It has, moreover, half shouldered itself out of the earth, and all down its exposed flanks are blow-holes which, during a stoking, belch forth fire and smoke like some crazy monster of dreams. As the fuel supplied to the main fire-mouth at the lower end is not sufficient to heat the entire length of the tunnel-like chamber, the latter is fed with thinner wood between the ranks of pots through the blow-holes, in slow progression up the slope as the temperature rises. The flame and smoke from the holes show the rate of fuel consumption and at the same time are an indication of the atmospheric conditions within. The pots themselves can be clearly seen through the holes when the flames die down.

The chief drawback to this tubular kiln must have been irregular heating, so the Korean potters who were brought as prisoners of war to Japan some 300 years ago began to break up the long single chamber as the Chinese had done long before





Japanese climbing kiln: up to 20 chambers—mainly oxidized

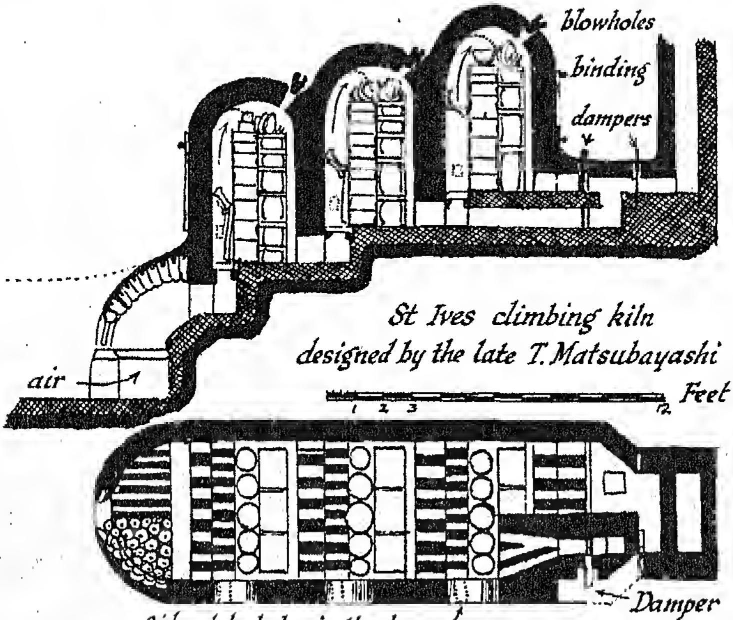
into separate compartments with inlet and outlet flues at the bottom of the dividing walls. This had the effect of turning it into what is now called a *semi-continuous down-draught kiln*. The final development in Japan has been the separate arching of each chamber on the upward slope, which acts as a chimney, and the gradient determines the draught and to a considerable extent the prevalent atmosphere. The largest kilns of this kind have as many as twenty chambers averaging 40 by 10 by 10 feet; they take about two weeks to fire, and hold at least 100,000 pots. Our three chambered kiln at St. Ives was built by the late Mr. T. Matsubayashi, who was one of the thirty-ninth generation of the Uji family of potters,[1] and although very small, each chamber measuring 6 by 6 by 4 feet, it holds an average of over 1,000 pieces. It is interesting to note that when the question arose of erecting a modern Western kiln in place of it, we were advised by one of the leading kiln designers in England not to do so, as its plan was excellent.

Strange as it may seem, these climbing kilns in Japan and Korea are covered with thatch often only a few feet from the blazing port-holes, but I have never heard of one catching fire. The stokers are naturally expert firemen, and, in any case, the loss of a light thatched roof would be of no serious consequence in a country where labour is so cheap.

Stoking kilns with wood fuel is far from a mechanical job, and in the East it is often done by specially trained men who attend a circuit of local kilns in rotation. Bank kilns perhaps more than others have their humours, with which one becomes familiar by experience much in the same way as a yachtsman learns to know the peculiarities of a sailing boat. One great advantage which they possess is that in a single firing pots requiring different temperatures and atmospheres may be packed in successive chambers. Those near the main stoke-hole are necessarily reduced, but the upper chambers can be oxidized at will. The *duration of the firings* of bank kilns, as of other types of

[1] The Asahi Pottery, Uji, Japan.

kiln, depends upon their size and construction, the skill of the stokers, the temperature required, the quality of the fuel, the state of the weather, and the contents of the kiln, whether large pieces or small, raw or biscuited.



St Ives climbing kiln designed by the late T. Matsubayashi

Side stoke-holes in the doors

In contrast to the fortnight required by the largest of the Japanese climbing kilns ours at St. Ives takes on the average thirty-five hours to reach 1250° to 1300° C. throughout. Of this time about two-thirds is spent in stoking the first chamber with large wood in the main furnace.

WOOD FIRING

Logs and split logs of absolutely dry pine from three to eight inches in diameter, and from two to two and a half feet long, are

used. At the commencement we feed two or three pieces every quarter of an hour into the ash pit, slowly working up to a maximum of a dozen logs every four minutes into the stoke-hole above.[1] The effect of each stoking is a burst of heat and smoke quickly followed by a clear flame which then dies down to ember. The blow-holes are kept half open and the character of the flame and smoke which blaze out indicates the kiln atmosphere. When the flames cease a fresh batch of logs are put in. This must be done quickly and deftly in order to stir the embers, so that the ash falls naturally through the firebars, as well as distribute the fuel evenly, thereby permitting the hot air from the ash pit to supply oxygen to as much wood surface as possible. This ensures good combustion and obviates the necessity of raking, which not only sends showers of ash amongst the exposed pots but also cools the kiln. The *atmosphere*, that is to say, the composition of the burning gases, is governed by the design of the kiln, by the quantity and kind of wood thrown in, by the frequency of stokes, by the amount of air let in at the ash pit and stoke-hole, and, finally, by the use of dampers. The disproportionately long time required for the main stoking is due to a variety of causes. The kiln itself and the pots are cold and damp at the start, especially if the pots are raw. This inherent moisture must be driven off slowly, and for that reason the blow-holes are left wide open up to red heat.[2] When the cones in chamber 1 (cone 9, 1280° C.) have all fallen, and the test rings[3] have shown that the glazes are well melted, it is usual to keep up a steady soaking oxidation to ensure equalization of heat

[1] The ashpit is only used for this purpose in the early stages of a firing, as soon as the firebars and walls are hot enough the fuel is transferred. The change takes place three or four hours after the start.

[2] At one pottery in Japan, in kilns containing large raw pots the *kiln doors* are left open with wood fires burning in each entry all the way up the slope for twelve hours or more before the firing proper commences.

[3] In country potteries in the East, and even in England, the experienced stoker depends upon his eyes, and cones and pyrometers are not used.

without attempting to increase temperature. By this time chamber II will have reached about 1000° C., and chamber III 700° C. solely by heat overflowing from chamber I. It is from this point that secondary side-stoking begins. The transition has to be very carefully managed in a small kiln, for there is a danger of losing the accumulated heat of chamber I if it is allowed to cool too quickly, while on the other hand, continued stoking from the main fire-mouth tends to consume the oxygen in the kiln, so that proper combustion of the secondary wood does not take place and half burnt embers soon choke the flues. This difficulty can be overcome by half opening the ash pit and keeping a few logs burning in the mouth of the main stoke-hole. But the wood must be very dry. It is an excellent plan to dry the wood for the next firing in a loft above the kiln, where it is exposed to the rising heat, provided reasonable precautions are taken against the danger of fire.

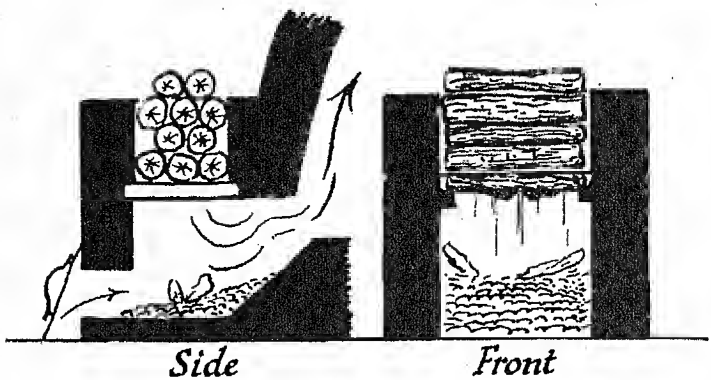
Intermediate sized climbing kilns of, say, twelve arches measuring 18 by 6 by 7 feet average only four hours per chamber, which, plus thirty hours allowed for main stoking, means a total of seventy-four hours, which is no more than double the time required for our three-arch kiln at St. Ives.

Continuous light stoking is seldom done with wood fuel, but we find it best in our third chamber where the draught induced by the chimney (added to the kiln in order to comply with local regulations) is strongest. The illustration shows a method of continuous automatic wood stoking with logs of fixed length.

An adequate verbal description of the handling of a potter's kiln is quite impossible, but I have given these details because I do not know of any book which describes the use of wood as a fuel.

Although the proportions and construction of kilns involve a series of problems of a complexity which only modern chemistry and physics can fully explain, it should never be forgotten that the most beautiful pots have been made without the aid of such knowledge. To a craftsman it is more important to know

what works well than to know in precise detail why it works well. Nevertheless it would be absurd for any craftsman to-day not to take advantage of the results of modern scientific research.



Semi-automatic wood grate

Mr. Matsubayashi, who was a well trained engineer and ceramic chemist as well as a craftsman, drew up the following practical rules of construction after a thorough examination of many types of kilns in different parts of Japan. They are convenient rules of thumb which we have found of considerable help.

KILN PROPORTIONS AND CONSTRUCTION

The following measurements are based upon circular proportions and must not be confused with square measure. To find the measurements of a rectilinear kiln an 8 foot 7 inch square must be taken as the equivalent of a 10 foot circle.

1. The height and the width of ovens should be approximately equal.

2. The diameter of the chimney should be between one-quarter and one-fifth of the kiln diameter.

3. The height of the chimney should be twenty-five times its diameter.

4. The total superficial area of the combustion chamber (or chambers) should be ten times that of a section of the chimney.

5. No flame-way between the furnace and the chimney top should be less in total section than the chimney flue, i.e. one-fifth of the kiln diameter.

6. The best speed for kiln gases is 0·8 metres per second. (The speed of the flames can be roughly estimated by putting a piece of copper into the stoke-hole and noting the time the resulting green flame takes to traverse a measured distance. The copper should then be withdrawn or it may affect the colour of the glazes.)

7. Whenever possible, flame should be conducted through curves in preference to angles.

8. Short chimneys cause slow firings.

9. Long chimneys occasion high flame velocity and irregular heating.

My own experience of kilns has taught me that there are many which function well and yet break one or another of these rules. The most sensible thing to do in building a kiln is to construct it in such a way as to make it possible to alter the furnace mouths, the flues, and the chimney without great difficulty.

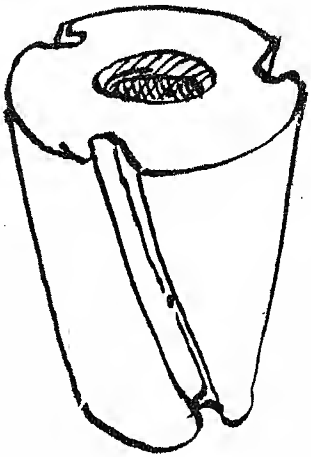
The foundations of any kiln should be protected from damp by a bedding of waterproof concrete covered by brick or quartz gravel to a depth of six to twelve inches to insulate it from damaging heat.

The materials of which kilns are built must be sufficiently refractory to resist the heat and strain to which they will be subjected. My first raku kilns were made of a single wall of sandy red brick lagged with two inches of mud, chopped straw and sand. They withstood upwards of one hundred firings at 750° C. For higher temperatures it is advisable to make the kiln lining and appurtenances of first class fireclay and grog. The

usual wall thickness employed is nine inches, the length of a standard brick, but for small kilns I have found a thinner wall satisfactory if it is lagged with a good non-conductor. Theoretically, the walls of a kiln should be as thin as constructional strength will permit, for the reason that thick walls absorb both damp and heat, and consequently slow down the earlier stages of a firing. Thus between the four factors of *heat resistance*, *kiln weight*, *expansion* and *radiation* it is necessary to find a happy mean in each individual case. In sharp contrast to the treble thickness of brick frequently to be found in our Western kilns are the Chinese kilns made of empty saggars, open end outwards, which only present an inch or so of thin fireclay bottoms to the intense heat within. How long such construction will stand up to constant use I do not know, but in Japan it is usual to rebuild the weaker parts of stoneware kilns each year after they have withstood some twenty-five firings. These Oriental kilns, as may be seen from the drawings, are built in irregular curves and are seldom bound together by iron bands to counteract heat expansion. In some cases they are constructed of blocks of raw fireclay, which are partially burnt by the firing of the kiln. This is only possible in localities where a peculiarly non-contracting fireclay is obtainable. The beehive construction of Far Eastern kilns lends itself to the kind of lagging I have mentioned. We in Europe use asbestos and kieselguhr, and, more recently, very light porous bricks. The principle of non-conduction of heat is based upon a sponge-like formation of minute air pockets. In theory, a vacuum would be best, but in practice air is the only alternative. The cheapest and best non-conductor is wood ash, which is easily obtainable from the burning of hedge clippings and weeds. The whitish or grey ash should be dry sieved, and mixed with sufficient sandy clay to bind it.

For all domes I recommend the use of hollow slotted cones made by hand, as illustrated, and filled with ash and clay and basted over the whole surface with the same mixture to a depth

of two or three inches. By this means a thin, well-insulated shell, with the strongest bonding, can be constructed at a most moderate cost. The building of domes with such hand-made cones, whether solid or hollow, is very simple because the work is done from the supporting walls towards the crown and a light support is required only for the final horizontal courses. Any curve can be readily followed by proper selection of the slightly varying cones and by the use of more or less mortar. The latter must be used more freely than in normal brickwork, and the



percentage of grog to fireclay should be very high. Our main firemouth dome at St. Ives was built of solid cones, only soft biscuit fired, fourteen years ago and has withstood rough treatment very well.

The length of firings and *atmospheric conditions* in a kiln are considerably affected by the weather. Strong gusty winds alter the pull of a chimney, especially if it is short. Roof eddies increase irregularities in the draught just as with ordinary domestic fires, but it is better to have the chimney end of a kiln exposed to prevalent winds than the furnace end. Such difficulties can be overcome by the installation of electric suction fans in place of tall chimneys, but this only adds to the complication and expense of a small pottery, and means dependence on a mechanism, the failure of which might spoil a firing. In the East it is recognized that heavy damp weather is more suitable for reduced glazes, such as celadons, and bright clear autumn weather for oxidized iron glazes, variously called *kaki* (persimmon red), *tessha* (mottled rust and black) and *tenmoku* (black), by the Japanese.

Three years ago when I was working in Japan at Hamada's kiln a great typhoon arose during the firing, and, as luck would have it, the wind blew straight into the open shed in the direction of the flames. No barricades which we erected could keep it out. The draught was such that the glazes were melted hours earlier than usual. At the time we congratulated ourselves when we saw the pottery all shining in its brilliant whiteness through the blow-holes, but when the kiln was opened we found the sides of the pots away from the flame quite unmelted, and practically everything had to be refired. The police arrived just as we had finished, to ask us to stop stoking because of the danger of sparks starting a forest fire. They had just come from another village kiln half a mile away. There the first three chambers were finished and seven remained. The potters promptly closed the fire-mouths and stopped up the exits, and when the wind fell five hours later they re-opened the fires and went on as if nothing had happened. The results in the first chambers were like ours, but the other seven were saved.

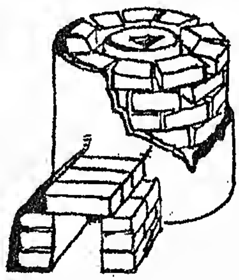
The duration of a firing naturally depends upon the temperature to be reached, but this is not, as one might suppose, a steady progression. The greater the heat the slower the increase. The reluctance of many kilns to rise from about 1200° C. to 1300° C. has been to many another potter besides myself a cause for anxiety and even desperation. The firing is the climax of the potter's labour, and in a wood-fired kiln of any size it is a long and exhausting process. Weeks and months of work are at stake. Any one of a dozen things may go wrong. Wood may be damp, flues may get choked, bungs of saggars fall, shelves give way and alter the draughts, packing may have been too greedily close, or for sheer exhaustion one may have snatched an hour's sleep, handing over control to someone else and thereby altering the rhythm of the stoking. At white heat things begin to move, to warp and to bend, the roar of combustion takes on a deeper note—the heavy domes crack and tongues of white flame dart out here and there, the

four-minute stokes fill the kiln shed with bursts of dense black smoke and fire. Even in the East, where hand work is usual and labour specialized, a big kiln firing has the aspect of a battlefield where men test themselves to the utmost against odds. This may sound like discouragement, but it is no more than the simple truth.[1]

RAKU KILNS

In Japan, raku and overglaze enamels are traditionally fired with wood or charcoal in small up-draught muffle kilns. It is also common practice to use the same kiln, with the muffle or protective inner box removed, for the preliminary or biscuit firing, which in the East is done at about 700° C. for all wares. The charcoal-fired raku kilns of about the size and shape of an ordinary iron studio stove are often portable, and a potter can sometimes be hired to bring one of these to a private house for an afternoon's entertainment of guests such as I have described in Chapter I.

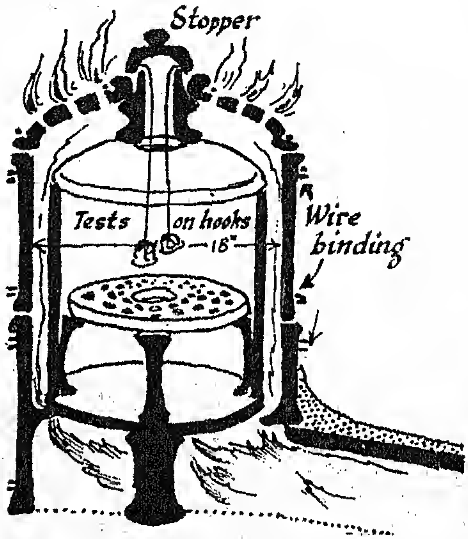
Temporary kiln



In England, practically any kiln can be used for firing raku. The temperature is low, 750° C., and the usual atmosphere is oxidizing. The only exception is in firing red raku, when a little smoke is useful in giving the irregular grey patches which are frequently to be seen on tea-bowls. A simple kiln of the rudi-

[1] There are young people who imagine that they can play at potting, condescending in their opinion from fine art to a craft which they expect to learn in a few weeks or months, buying everything ready-made, and avoiding drudgery by mechanical devices. Pottery is still being made, or decorated, under this misconception. It would be well both for potters and public to realize that the results of such performances look precisely what they are, unhappy exhibitions of dilettantism in a mechanical age.

mentary bottle type, resembling the British-Roman kiln, already referred to, is probably the best for small scale potters who prefer to use wood for low temperature work. Such a kiln can be built on a very small scale with rough materials like broken red brick, mud and sand, to hold one saggar as a muffle. I have often knocked up a temporary biscuit kiln in this way to hold a



Tomimoto's biscuit, raku or enamel kiln
Three hour firing with thin pine

dozen or two pots, for which room could not be found in our regular biscuit kiln. From this one may progress to a somewhat larger kiln with a better muffle and an outer wall made of soft-biscuited thrown fireclay and bound with wire, as shown in the illustration; or a well-built kiln of the smaller kind can be constructed of ring bricks of whatever size is found suitable for permanent use. In this way one's experience is bought cheaply.

SOFT BISCUIT PACKING

The packing of dry raw pots in a biscuit kiln varies so slightly in the case of raku from that of any other ware that the following notes may be taken to apply to all soft biscuiting.

In Europe the strength and hardness of most of our commercial wares is due to the first unglazed firing, which is done at a higher temperature than the subsequent glost firing. In the East the process is reversed and the first firing is done at a low red heat, 700° C. This is enough to alter the chemical composition of the clay so that it will no longer disintegrate in water, and it makes the pots hard enough to stand handling and absorbent enough to take a coat of thick glaze in one dipping.

The pots are stacked on the kiln floor according to size and shape and strength of wall and lip, to bear the weight of the layers above. At the same time they are so placed as to allow of the passage of the flames throughout the mass. Danger of warpage is slight, and a thousand pots can thus be fired in a chamber which will only accommodate a quarter of that number of pieces if glazed. I have seen a round biscuit kiln in Japan, 10 by 10 feet, packed without the added support either of shelves, saggars or props.

The dangers to be guarded against are: (1) *bursting* of thick pots due to too rapid a rise in temperature; (2) *dunting* caused by cold draughts; (3) breaking of thin pots under too great a *strain*; (4) *underfiring* of pots at the top of the kiln; and (5) *overfiring* at the bottom, both due to bad placing or unskilled stoking.

SOFT BISCUIT FIRING

For kilns of 12 to 24 inches internal diameter three to five hours should be sufficient for biscuit firing small light ware, and

an hour less for the glaze. The first quarter of the firing should be dead slow with a couple of pieces of wood, two to three inches in diameter, at a time. During the second quarter three or four one to two inch pieces should be burning together. In the third quarter the kiln and the pots should be free from damp. This can be ascertained by holding a piece of metal or glass for a couple of seconds over the top of the kiln and observing whether any condensation takes place. If not, the stoke can be increased to six pieces of not over one inch in diameter, all carefully kept crisscrossed to ensure good combustion. It is during this part of a biscuit firing that bursts may take place, and if this should happen, the stoking ought to be slowed down for at least half an hour. At the end, even more wood can be used, and the thinner the better. It would be advisable for beginners to allow somewhat more time than I have suggested for the first half of a firing, and gradually to shorten the hours with the confidence gained from personal experience. As soon as the uppermost pots are clear of soot (with which they get thickly coated) and have become dull red all over, the firing can be stopped, the fire-mouth closed, and all cracks thoroughly basted with a half-and-half mixture of sand and mud to prevent any currents of cold air from dunting the wares. Sometimes, when the biscuit has been packed very tight, it is difficult to get rid of the soot on top. When that happens the Japanese employ what they call 'sky firing'. The fuel at the fire-mouth is allowed to die down to ember, and then slivers of wood are inserted amongst the pots at the crown of the kiln. They catch alight, and in a few minutes burn off the soot which the flames from below could not properly reach. The kiln is then closed in the usual way.

Only towards the end of the firing should fresh wood be thrust right in under the circle of the kiln, and even then only a few thin pieces; but old embers may be pushed in by the fresh wood.

Japanese Enamelled Stoneware Jar. Old Banko ware copied from an imported Delft drug pot. Two centuries ago the Japanese artizan could achieve as lively a translation of European form, pattern, and colour as this.

RAKU GLAZE FIRING

The first period of slow heating can be practically dispensed with in firing glazed raku, as there is no danger of bursting. The pots may be packed more closely than is usual, they may even touch one another slightly, because, when they are taken out red hot with long-handled tongs, the glaze wound quickly anneals. If the slight irregularity of surface which shows where they have been touched troubles a European's aesthetic sensibilities, it is a simple matter to pack them in the usual way, but it may be said that the Japanese, far from disliking this stamp of the making, only look to see if the result enhances the general effect.

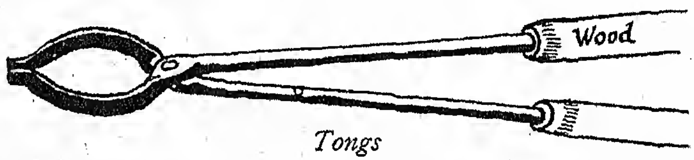
Raku pots can be refired with or without the addition of more glaze. It is always advisable to put the fresh batch of pots round the top of the kiln for at least ten minutes before they are placed in the red hot muffle. Moisture has been absorbed from the glaze, and this must be driven off first, or the pot may burst like a raw pot and scatter its fragments all over the half-melted glazes with disastrous results. Cones are not used at this low temperature as it is so much easier to see what is taking place in the little kiln. It is worth remembering, however, that glazes on pots always look more melted in the kiln than they are in actuality, so the beginner will be well advised to wait patiently until the surface has the appearance of ice in sunlight. The reflection of a cold iron rod placed alongside a pot in the kiln shows still more clearly how far the melting of the glaze has advanced.

If a thick glaze begins to flake off when a raku pot is being warmed over the kiln, it indicates either dust or grease on the biscuit before dipping or too little siccative[1] in the glaze mixture. Pin-holes in the glaze are due either to dust or to coarse granulation in the clay, but they sometimes become centres of discoloration which may be beautiful. The latter are caused by

[1] See p. 151.

alterations in the kiln atmosphere, as for example, when a pot with a reduced light grey body covered by a clear glaze has pink patches round minute pin-holes. What happened was, that towards the end of the firing the atmosphere was oxidized, and the oxygen worked its way under the glaze from the pin-hole entry and turned the iron in the clay back to its oxide form around that point. Grey patches on a pink or red pot would be due to a reverse action.[1]

The *tongs* used for taking out and putting in the pots are usually about a yard long. Any blacksmith is capable of making them, but he should be told that they must be very light and well balanced. The pots when taken from the kiln are placed on bricks or tiles to cool off. As soon as the muffle is emptied of one



Tongs

batch it should be filled with the next, so as to waste as little heat as possible. After the first lot is done, the stoke-hole and ash-pit (if there is one) should be closed until the next batch is in, when the firing is resumed at maximum. Each successive batch takes less time, so that if we assume that the initial stoking took three hours, the second will take about one hour, the third forty minutes, and so on down to about twenty minutes.

OVERGLAZE ENAMEL FIRING

The firing of enamels is done in muffle kilns in an oxidizing atmosphere at about the same temperature as raku, but the commencement of the firing must be more gradual, especially in the case of large pieces of porcelain, as they cannot stand

[1] Such local discoloration may also take place in higher temperature wares if the bodies contain a small quantity of iron.

abrupt heating or cooling. For this reason also it is necessary to cool the pots slowly in the normal way.

SETTING AND FIRING GLOST SLIPWARE

The setting, or packing, of lead-glazed slipware is peculiar only when the pots are glazed on the raw body, or the glaze contains sulphur. In the former case the precautions taken in biscuit firing must be combined with those of an ordinary glost firing. That is to say, the natural and combined moisture of the clay must be driven out slowly in proportion to the fineness of the clay and the thickness of the wares. In practice, a round kiln of the kind I am now describing, three feet in diameter, which takes about six hours to reach raku temperature and ten or eleven hours for slipware, should be given two or three hours longer if the pots are large, thick walled, or made of very smooth clay. With enclosed or muffle kilns it would be better to allow a more ample margin of safety, because the damp cannot escape from them as easily as from open chimneyless kilns.

At Truro, and at Michael Cardew's pottery in Winchcombe, where both kilns are of the old English bottle-neck type, with chambers eight to twelve feet in diameter and several fire-mouths, it is customary to pre-heat the raw wares the day before the proper firing. At St. Ives we warm up our round kiln with a drip-feed of paraffin into a saggar half full of wood ash set in the ash pit. This burns without attention all night preceding a firing, and gives off a flame about twelve inches long. We have also found that this combination of oil and wood lessens the labour considerably during the actual firing, and the slow drip is gradually increased to a steady flow of the thickness of a match as the firing goes on. Without a chimney it is not possible to obtain a sufficient pull of air to give complete combustion to a larger quantity of oil, and any further increase only results in a dense cloud of smoke.

Wares glazed with galena must be packed in a very open way

to avoid *sulphuration*, that is to say, in saggars with holes large enough to allow the flames to reach the pots. Closed saggars are unsuitable, and covered pots should have their lids placed separately. Bottles with narrow necks must be glazed inside with a glaze partly or wholly composed of a form of lead into which sulphur does not enter,[1] and large dishes are packed face downwards on stilts, or sometimes, if the rims are not glazed, on top of one another.

Slipware is fired under conditions of predominant oxidation, but complete oxidation tends to yield disagreeable hot colours. Reduction, on the other hand, makes the body grey, and under a greenish glaze the effect can be just as unpleasant, while the surface tends to be bubbly. It is essential to know one's kiln very well in order to steer a fair course between these extremes. Moderate reduction is what one aims at, continued for a hundred degrees or so just before the glaze begins to melt, between 750° and 900° C. This procedure has the effect of sealing in some of the reduced colour of the clay, which cannot be much altered once the glaze has melted. After it has reached that stage reduction has the effect of causing the glaze to bubble violently, and this can be clearly seen through the spy holes. The bubbling will subside almost as quickly with steady oxidation. Up-draught kilns are best for galena glazes, but they often present difficulties in equalizing the heat from the bottom to the top. At Truro it is the practice to finish the firing with furze, and at Winchcombe with brushwood faggots, which throw up a long soft flame and carry the soaked heat to the top of the kiln. A pause of a few minutes is made after the 'glows' have been raked out at the end of each stoke. Coal is not objectionable for brown wares because the 4 per cent. to 5 per cent. of sulphur it contains does not injure the colour as is certainly the case with white wares. Since galena contains sulphur, it is not advisable to pack white wares with galena-glazed pots.

[1] Fritted lead silicate, Wenger's G 682, melting at 800° C., serves very well for this purpose.

SALT-GLAZE PACKING AND FIRING

In the old days the packing of a salt-glaze kiln somewhat resembled the biscuit packing already described. It is true that the volatilized salt covers everything in the kiln which contains silica with a thin coat of glaze, but its action is far less drastic than one might suppose, and although the old bellarmines show scars they do not appear to have stuck together in such a way as would cause serious damage, although packed in direct contact with one another. We have had only two salt-glaze firings, which took place at times when our round three-foot kiln needed rebuilding and we could, therefore, afford to use it for such experiments. I felt certain that the qualities of old salt-glaze were due to the character of the clay and to wood firing, and our attempts fully justified this belief. The kiln took eighteen hours, and 4 lbs. of coarse salt were thrown on the wood at a little over 1200° C. This caused a dense white smoke to pour out of the kiln and down the Land's End road, to the alarm of the stokers, who rushed out of the pottery fearing to see passers-by fall in their tracks overcome by chlorine fumes. The salt caused the temperature to fall, and after half an hour or so a second dose of 4 lbs. was given and the temperature maintained at 1250° C. for another hour.

Salt has a disastrous effect upon other glazes, and once a kiln is impregnated, it is very difficult to cure. It makes stoneware glazes crinkle on the edges of pots, and turns otherwise bright glazes matt. Of course, it is not necessary to pack the pots in the primitive method described, but they must be very openly placed.

On the average 1 lb. of salt per cubic foot of kiln capacity will give the best results. Directly after throwing the salt well into the furnace when the stoke is low, dampers and stoke-hole doors or covers should be closed for a few minutes to hold the gases in the kiln. Walls and fixtures should be very aluminous

and relatively free from silica. The kiln cannot be used for any other ware.

FUEL

The fire-mouths of kilns are built to suit the fuel to be used. Wood takes up more space than coal, and coal more than oil or gas. *Charcoal* and *coke* give off a glowing heat, rather than a long flame, and so they are usually banked round a muffle with plenty of air inlets, much on the lines of a roadside brazier. *Electricity* is a purely radiant heat and requires no fire-mouth or outlet to a chimney. My own experience has been limited mainly to wood and oil. The larger round kilns to which reference has been made in this chapter could all be adapted for coal, oil or gas firing. For coal the firebars should be closer together than for wood, and the ash-pit must be sufficiently deep and open to allow a good draught, otherwise the bars may bend from excessive heat. The best type of coal for long flame and high temperature is gas coal. For lower temperatures, long flamed sandy coals are largely used. Coke is well adapted for the steady slow heating at the beginning of a firing, especially of raw wares.

Fuller information in regard to European kilns may be found in the excellent standard work on Ceramic Industries by E. Bourry.[1] I must point out, however, that his statement to the effect that high temperatures cannot be attained by the use of light woods is erroneous.

Oil has not been much used in Europe until recent years, but in America it is extensively employed, especially in small potteries. In the form of paraffin, or even thin fuel oil, it can be burnt by means of a natural draught induced by a chimney. The *Drackenfeldt* and the *Revelation kilns*[2] manufactured at

[1] *A Treatise on Ceramic Industries*, Emile Bourry. Scott Greenwood & Son.

[2] Revelation Kilns, 10125 Jefferson Avenue, East, Detroit, Michigan.

Detroit in the U.S.A. in various sizes suitable for studio use, are economic and very effective. I have had one of the latter, and can recommend it for temperatures not exceeding 1200° C. The method of radiating the heat is peculiar: a muffle is formed by conducting the flames up thin replaceable fireclay pipes, with which the wall of the kiln is completely lined. In the Drackenfeldt kiln hollow bricks are used for a similar purpose. In the Revelation kiln the oil is drip-fed into a pan, from which the flame is drawn into the combustion chamber and from thence up the pipes. Between the pan and the inlet to the kiln are four perforated flaps, which, by opening and shutting, regulate the atmosphere. This principle could be applied to any small kiln with a chimney to make a sufficient draught.

Unfortunately, owing to the import duty and freight charges, these American kilns are expensive to buy in England. Commercial oil-kilns are fired with crude oil, which is atomized by a pressure of air or steam varying from four to one hundred pounds to the square inch. For the studio this is an expensive and often noisy method of firing, but there is no doubt that especially for high temperatures such oil blowers are very effective, and the big oil companies, such as British Petroleum and Shell Mex, are quite willing to lend the assistance of their engineers to any potter who proposes using their oil. I can also recommend Mr Askam, Avenue Road Works, Aston, Birmingham, as a designer of oil fired kilns who has been of great assistance to several potters whom I know.

Of *gas* kilns I have had little personal experience, but there are many on the market, and they are much used in art schools. One of the latest, designed by Mr Charles Vyse for the Gas Light & Coke Company, is constructed to withstand stoneware temperature. One of my students has also obtained good results from the Deep Recuperative Gas Muffle made by the Incandescent Heat Co., Ltd., Cornwall Road, Smethwick, Birmingham.

In the case of *gas kilns* the burners have air inlets to control

the mixture of air and gas. In kilns fired with paraffin, or heavy oil, this is more difficult, owing to the liquid nature of the fuel. Nevertheless air must be given access to the burning surface in as direct a way as possible. Besides this primary air there must be a supply of secondary air whose access to the kiln should be controlled: *it is the supply of this secondary air which normally determines the state of the kiln atmosphere.* When, however, primary air is supplied under pressure and control a secondary air supply may become superfluous. If the secondary air can be preheated by an adroit arrangement of the flues, the flames become more powerful and a great economy is effected.

The building and use of very inexpensive *coke* kilns is described in detail in *Handcraft Pottery* by Henry and Denise Wren.

For temperatures up to 1200° C. there is a wide choice of kiln for studio workers; but for stoneware and porcelain it is difficult to find a small, reliable kiln, made in England, which is not expensive.

There is a new *electric* kiln on the English market, the Grafton kiln, made by the Applied Heat Co., Claydon, Ipswich, Suffolk, which is suitable for the small-scale worker at temperatures up to 1300° C. Its upkeep and cost are not prohibitive, and a reducing atmosphere can be obtained by the introduction of thin pieces of wood without damage to the heating elements. It is very simply and conveniently constructed, and the temperature in all parts of the chamber is remarkably even. We have fired stoneware tests in it with good results; but the replacement of burnt-out heating coils, or elements, involves an occasional outlay, and we would advise anyone to switch on the power in slow stages if the wares are packed in very close formation.

Only one other type of kiln need be mentioned here, because it seems to mark the end of a long evolution. I refer to the *tunnel* kiln, which of late years has been playing an increasingly important part in mass production. It consists in a series of truck loads of pots moving slowly through a tunnel, of which the

central portion alone is heated to a constant temperature. The movement is imperceptible to the casual glance, but the average time taken by a truck to enter cold until it emerges cold again at the other end is twenty-four hours. Work never ceases, control is very exact, loss reduced to a minimum, and the output enormous.

PACKING A STONEWARE KILN

In firing stoneware and porcelain even more difficulties are encountered than in firing softer wares. One must take still greater care, for in the neighbourhood of 1300° C. even refractory clays warp under pressure, more fusible bodies, like porcelain, need but the slightest tilt to go out of shape, and glazes which will turn steel when cold pass through a series of molten transmutations.

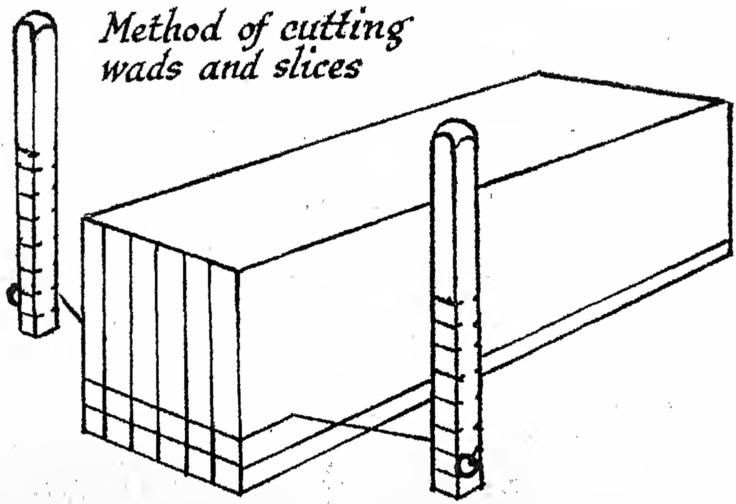
Upon opening a stoneware kiln, especially if it has been wood-fired and reduced, the kiln fixtures are glass-bound and glisten with a thin coating of volatilized glaze. Saggars at the bottom of a bung have to be split apart with a crowbar, despite the use of coils of special refractory material to keep them separate. Shelves of fireclay two or three inches thick may bend and touch the lips of a dozen pots carefully placed beneath them, or the flat bottom of a saggar may sink under a teapot with the consequence that a circle of egg-cups lean inwards and get stuck fast to it with glaze. Such amongst many like happenings may give a clue to the care and foresight required in packing a stoneware kiln. The kiln furniture, such as shelves, props, saggars and the like, must be well made of first class materials all fired to one temperature, so that there will be no further contractions. Of these an ample stock ought to be kept in sizes adapted to both pots and kiln. With suitable fireclay and grog a potter can make most of them on the spot and bake them in the first firing of a new kiln, for when a kiln is newly built and still damp one must not expect to get good glaze results. New sur-

faces are inclined to suck glaze from adjacent pots, and it is a good plan to baste vertical and overhanging areas with a thin wash of waste glaze to counteract this tendency.

The next thing to do is to array the pots near the kiln, and to make a rough selection of what can go most economically into each part according to the shelving and the space required for the saggars. At this point it is necessary to consider if some parts of the chamber are habitually cooler than others, and to set aside pots with softer glazes to go into them. Conversely one finds out from experience that certain effects are due either to greater heat or to exposure to the flame itself, and accordingly space for the right pots is reserved. Then follows the lay-out of the packing to assure equal draughts and distribution of heat. A general principle to be followed is that 'if the outside is hot enough the inside will take care of itself'. This means that if the flames are well distributed round the inner surfaces of the kiln walls, the radiation will concentrate upon the centre of the chamber. The wider the kiln and the faster the draught, however, the less this rule can be depended on. Before beginning to pack it is advisable to examine, clean, and, if necessary, mend any kiln furniture or fixtures. Broken parts are best mended with dry powdered fireclay and waterglass. Props must be checked to see if they will stand the strain of another firing, cracked shelves must have additional support or be replaced, saggars which have split into halves should be bound with cord to hold them together until they are re-set in a bung. The Japanese use rice straw ropes, and it is interesting to see their frosted skeletons still adhering to the saggars after a firing. Shelving and saggars ought to be carefully dusted and any projections chipped off with a cold chisel.

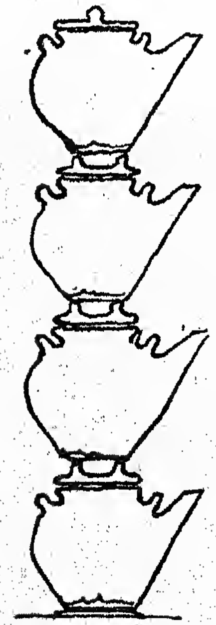
Then comes the making of 'snakes' and 'biscuits'. The former are long rolls of fireclay dusted with quartz sand or other refractory powder. Their thickness depends on the thickness of the saggar walls, usually $\frac{1}{2}$ inch to $\frac{3}{4}$ inch suffices, and they are made between the palms of one's hands and by dia-

gonal movement of the flat hand on a table. Or strips may be cut as the illustration shows. Biscuits are something like plate mats, and are made of the same clay as the pots which are to stand upon them. They should be beaten out on a table with a



wooden bat, from balls which have been rolled in the same non-adhesive sand or powder. Plenty of sand should be used to prevent the clay from sticking either to the bat or the table, and the finished thin biscuits when made are best covered with a damp cloth, as they harden rapidly. Their purpose is not only to prevent the pots which rest on them from adhering to shelf or saggar, but also to serve as a bedding both when packing and, later, when the foot ring of the pot contracts during the firing. Another method is to put a layer of sand on the kiln shelving, or in the saggars, and it is one which the Chinese potters used, especially during the Ming dynasty, even for porcelain. There are certain disadvantages however; sand adheres to the glaze if the latter comes down to the foot, and it gets scattered about the kiln and often into pots. The placing of fragile pieces with thick friable glazes into every inaccessible corner of a restricted space

calls for patience, without the added exasperation of having to unpack a whole shelf because a few grains of sand have fallen into the pots on the one below. This is not so likely to happen if the top shelves are packed first. Porcelain pieces are often mounted on porcelain rings, which have been carefully thrown and turned. This precaution is the more necessary when the ware is thin and raw glazed. Three years ago I gathered from the kiln dumps at the great pottery centre of Seto in Japan one or two specimens of egg-shell porcelain tea cups, as thin as thick paper and as translucent as white glass, together with the cone shaped stands upon which they had been packed upside down, for the reason that the handles would have pulled them out of shape if they had been fired the right way up. The very edge of the lip is unglazed but subsequently polished, so that this characteristic is not noticeable. Thin flat wares also present the greatest difficulty in firing at high temperatures. Besides the obvious precautions of making them of strong clay and of shape and section to resist the tendency to sag, they must be set on very level bases and fired evenly.



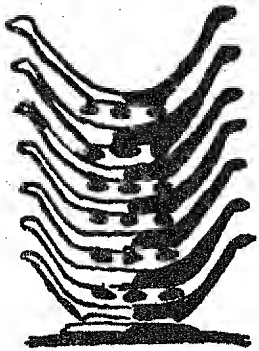
Stacking teapots

It is a good rule to pack glazed wares with a minimum spacing of a $\frac{1}{4}$ inch between each pot and its neighbours, but it is one I must confess to breaking. The temptation to squeeze in an extra pot or two, especially towards the end of a packing when some favourites have been left out, is very great. I can only warn others that it is a very mistaken economy.

For oxidization the pots should be packed more openly on shelving and saggars. The latter must be either perforated or, at any rate, not tightly closed with rolls of clay. For reduction, on the other hand,

they should be closed as tightly as possible, and some potters in the East who are attempting flambé effects go so far as to use *double saggars*, packing the space between full of charcoal or retort carbon.

Bowls of uniform size are often packed in saggars, the bottoms of which have been rounded in a mould so as to fit within the circumference of the bowl beneath, thus saving kiln space.



Oriental method of stacking bowls

The height of a saggar can be increased by rings, or by inverting another saggar over it. At many potteries in Japan and China saggars are hardly used at all. This is the case at Hamada's town of Mashiko, where pots are packed in tiers, as the illustration shows. This can only be done when the parts which touch are such as may be unglazed, and are strong enough to withstand the strain, which is least in a quick oxidized heat.

Unless an electric pyrometer is available, *Seger* or *Standard*[1] *cones* are the best means of gauging temperature. These are elongated pyramids about one and a half inches in length, made of materials used in glazes. They bend, or squat, at intervals of about 25° C. It is usual to set them aslant in threes in a socket of fireclay. Seger cone 9, which fuses at 1280° C., indicates our average temperature, and we use cones 1, 8, 9 and 10 in several parts of each chamber. Cone 1 (1100° C.) is a useful guide to the temperature just before the glazes begin to melt, when reduction, if there is to be any, must take place. The cones should be placed in positions where they can be easily seen, and it is also expedient to put them where they are protected from fierce kiln draughts. Beside the cones we use a number of test rings

[1] Standard cones require about 10° C. more heat to cause them to squat.

touched with cobalt and brown iron pigment and covered with glaze. These are hooked out of the kiln towards the end of the firing as an evidence of atmosphere as well as temperature. When the kiln is full the doorway is blocked up with bricks and fireclay mortar, and well basted outside with a mixture of sand and slip; dampers are opened, and strengthening bars or chains tightened. The kiln is then ready for fire.

COOLING

As I have indicated upon p. 168 certain glazes require fast cooling, but it is a safe rule with ordinary wares to allow as many hours for the pots to cool as it has taken to reach their maximum temperature. As a matter of fact there is no danger of dunting them before they come down to a dull red heat, therefore in case of need the kiln may be rapidly cooled to that point. Then it is wise to see to it that no fine cracks in the clamming let in cold draughts of air. With thick wares and fine vitrified bodies it is advisable to delay the cooling by keeping fire mouths, blow-holes and dampers closely shut till the pots are cold. Certain effects of glaze surface may be facilitated by producing a reduced atmosphere for a short time during the cooling at round about 700° to 800° C. The lustres are of this order. Related but quieter effects can be obtained in the same manner with stoneware glazes in which metal oxides, particularly iron, are present in some quantity.

Chapter VIII

THE WORKSHOP

A friendly and inviting atmosphere in the rooms where pots are thrown and decorated, good lighting, reasonable orderliness and quiet, the tools and furnishings attractive in themselves, however simple, and a few specimens of first-rate pots against light toned walls make all the difference to the mood in which work is done. An individual potter's workshop means more to him than a mere setting where the routine of production can conveniently go on. Here he has to seek and weigh new ideas, comparing them and his finished work with the standards of the past and the needs of an unborn future.

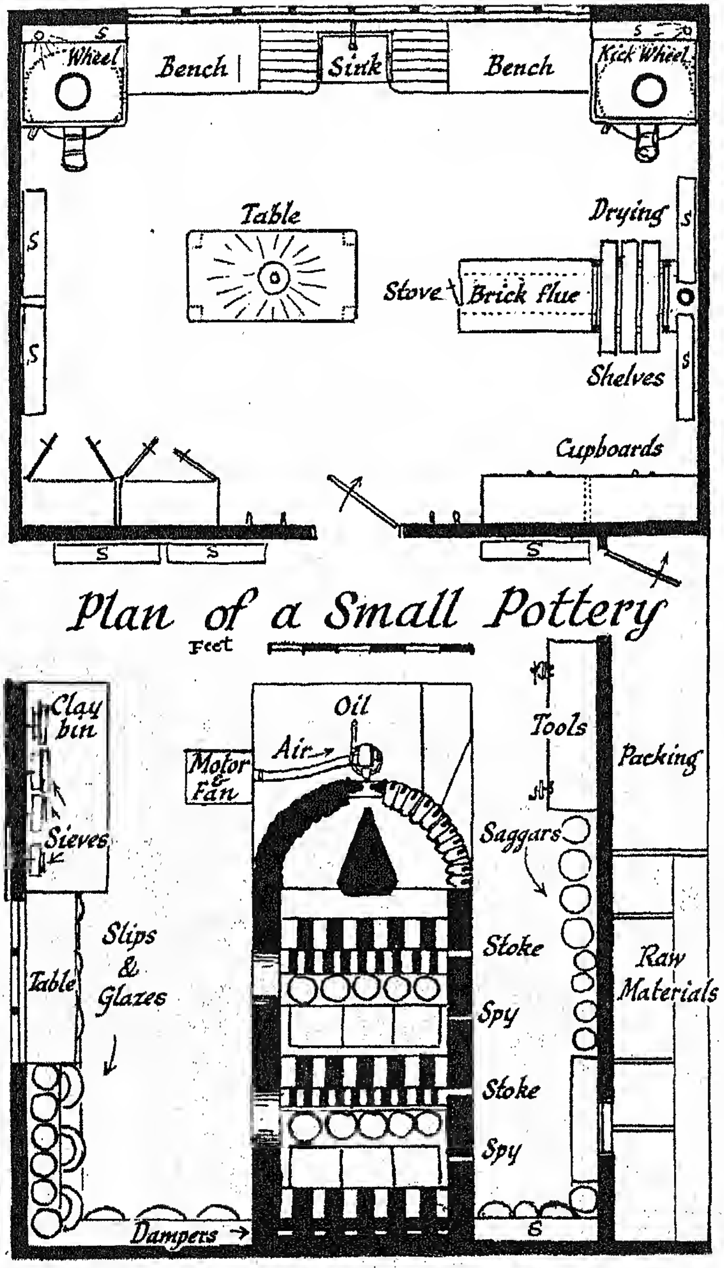
SELECTING A SITE

The selection of a site for a new pottery requires careful consideration and forethought. With a limited and very scattered public for sound handcrafts, every possible aid to sales has to be considered. Proximity to rail, post and clay are almost indispensable. Freightage is a serious item in the year's budget even of a small-scale pottery. A showroom at a good pause on an important motoring road, or at some focus of interest, possibly combined with a tea-room run by a partner, may make the difference between success or failure. It allows the pots to be seen in use in appropriate surroundings and gives the visitor a breathing spell during which to consider unusual purchases.

PLAN AND SCALE

The lay-out of a pottery should be determined by the progressive stages of work from the reception and storage of raw material to the final display of the finished pots, or their despatch to agents and customers. Clay making, throwing and moulding, decoration, slipping and glazing, kilns, office work, stock and showroom and packing have all to be considered in relation to one another. It would still be a small pottery run by from three to six people which allowed the equivalent of one room for each of these purposes. That is about the size of the St. Ives pottery. As, however, this is somewhat larger than most studio potters are likely to require, a plan is given of a large workroom and a kiln shed in which, besides packing, firing and unpacking, the clay could be prepared, the biscuit stored, and slipping and glazing done, thus freeing the studio from the rougher and dirtier work. If a potter is limited to a single room it is almost essential that he should buy his clay ready-made and depend upon a paraffin, gas or electric kiln.

A piecemeal description of the tools and procedure of even such an average studio pottery as this drawing indicates would be tedious to read, therefore I have attempted to give a picture in the following pages of the stages through which a batch of 200 to 300 stoneware pots would pass during the month which a couple of potters doing all their own work would take to make them from start to finish. I have elected to describe freely the work involved week by week, in the form of imaginary letters between friends, such as I have exchanged in Japan and in England. I do not know of any such description nor of a better way of bringing home to students, and possibly others, the actual life of a potter.

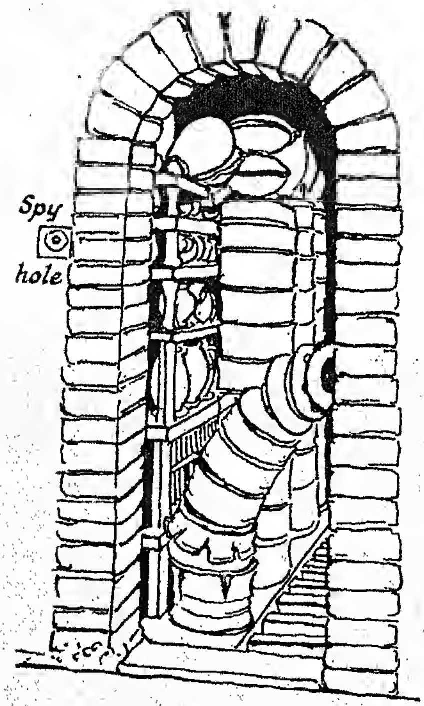

Plan of a Small Pottery
Feet
Wheel
Bench
Sink
Bench
Kick Wheel
S
Table
Drying
Stove
Brick flue
Shelves
Cupboards
Clay bin
Sieves
Oil
Air
Motor & Fan
Tools
Packing
Saggars
Slips & Glazes
Table
Stoke
Spy
Stoke
Spy
Raw Materials
Dampers

I. *Sunday, September 7, 193—*

Gains and Losses in the August Kiln

Dear X,

We have ourselves largely to thank for the losses in last month's kiln. Here is a sketch of what it looked like when opened. We took a risk with cracked shelves behind the bungs of saggars. They had held up so long with an occasional extra prop and a smear of refractory clay here and there that we had grown careless. It certainly does not pay, unforeseeable accidents are quite enough in themselves at high temperature. The saggar which telescoped in the first bung and threw the top section down, thereby choking the flues and altering the draughts, must have had a terrific grilling from the blast of flame which we played like a hose on the outer and colder side of the chamber in order to get cone 10 (1300° C.) to bend equally on both wings. Directly there was a breach in the wall of saggars the same heat flowed through to the shelf instead of over the top and down behind. Judging by the appearance of



Damaged contents of a high temperature kiln in situ

the glazes the temperature in this area must have reached 1350° C. The Seger cones which would have recorded the heat fell with the saggars. Another time we must protect the bottom saggars from the full effects of the blown oil flame by a thin wall made out of the same cracked shelves. The large open fired pots on the top nearest to the door tilted and stuck together, and the taller pieces below were spoiled by the two halves of the shelf sitting down on them, but to make up for this quite a few pots have come out a brilliant rust red, called by the Japanese 'kaki' (persimmon), turning to black where the glaze is thick, and the black 'tenmoku' glaze on others has turned red where it is thin on the rims, etc., just as old Chinese pots do. Unfortunately the celadons became quite transparent and glossy, and the crackle is fine, thus losing their essential jade-like character. Unluckily some of the pots we were banking on were in this part of the kiln, but there are about a dozen others which are really exciting and will be put aside for our next show in London. Out of 284 pots, 84 had to be thrown away or put into third class, and 188 went into ordinary stock. The biscuit in the second chamber came out almost perfect. Allowing one-third off for agents, etc., the selling value, after the pots had been labelled and priced, was only £55 against the average of £75 per kiln per month which we should maintain.

Cleaning up after a Firing

After the firing we had the usual cleaning up, the kiln was cleared of debris, the biscuits chipped off the shelves and saggars where the excess of heat had made the glazes run over them. In some places despite the use of biscuits and wads, or what we call 'snakes', lavishly powdered with quartz, a cold chisel had to be employed to chip off bits and a pick-hammer to prise saggars apart. Three factors are involved; first, the actual vitrification of the biscuits which, to save a wide foot from splitting as it contracts, should be made of the same clay, or an equally contracting clay, as the pot; secondly, the forming of a

thin coat of glaze where the alkaline salts in the flame combine with silicas in the clays; thirdly, sheer compression.

Thin Kiln Shelves

Then we replaced the $2\frac{1}{2} \times 12 \times 18$ inch Stourbridge bats of which the old shelving was formed by a new and more expensive variety made by the Morgan Crucible Company only $1\frac{1}{2}$ inches thick which is guaranteed to stand our temperature, atmosphere and maximum weight per square foot.

Blemished Pots

Some of the blemished pots were worth saving. In a few difficult cases we split pots apart under water with a wooden mallet, or with sharp light blows with a mason's trowel, and then ground the excrescences on the carborundum wheel and, finally, rubbed a little oil and umber on the scar. It is a pity people in England are so fussy about technical imperfections. Collectors won't look at a pot even though its aesthetic merit is as little affected as a Rembrandt drawing would be by a minor blot from his quill. The Japanese are more sensible in these matters and see to it that defects are repaired beautifully with lacquer, making no pretence at deception and often actually enhancing austere colours with a fine gold line. The Chinese, who waste nothing, have cracked or broken pots riveted for a few coppers and continue to use and enjoy them. The only thing to do is to keep such pots for people with perception and rigorously destroy those other technically perfect pieces which, whether because of the potter's or the kiln's shortcomings, have a bad nature.

After the kiln had been put to rights saggars were sorted by sizes and a note made of necessary replacements. We find that on the average they stand up to a dozen firings. Next the glaze tubs, etc., were put away and re-marked with oil paint where necessary. We also marked with Chinese ink (which burns out) the glazed pots which were left over from the last packing. This was done to save confusion later on, since it is difficult to recog-

nize some of these glazes from one another in the unfired state even if a biscuited plate with the descriptions in the centre and dabs of glaze radiating to the circumference is kept for reference.

So far the unpacking and clearing up together with the routine jobs had taken two days. The daily chores consist of cleaning, office work, clay-making and looking after visitors, besides variable details. Before we could turn our attention to the next batch of clay a couple of cases of orders had to be invoiced, packed, and sent off to agents. For such purposes we keep a stock of packing cases and small wooden boxes, obtained from chemists, next to the fuel tank up in the wood-loft. Of saggar clay and porcelain there was enough in the clay bin, but the stoneware body was almost used up last time and the next lot in the drier needed stiffening, wedging and kneading.

At this point we had a consultation as to what was to be made for the next firing, and found that we needed about 150 pots for stock and orders leaving kiln space for 100 experimental and exhibition pieces, including 30 large pots to be fired open on the top of the shelving or in the saggars, and perhaps 100 tiles to fill up odd spaces. For this quantity we estimated that 400 lbs. of stoneware clay and 100 lbs. of porcelain body would be sufficient—fifty 10 lb. balls of prepared clay altogether, allowing 1 lb. for the small, and 8 lbs. for large articles.

On Wednesday morning we shovelled the soft clay out of the drier on to the biscuited bats and made four piles ten deep. These bats we made some years ago of rough china clay with a little ball clay added for tensile strength and only fired them to 700° C. They measure 15 × 12 × 2 inches and have proved very satisfactory. The fireclay bats of which the kiln shelves are made are not sufficiently porous. The night before we had put them into the kiln, which was still warm, to dry off. After lunch we wedged until tired, what with interruptions and rests it took us until it was time for high tea and knocking off for the day.

Our method on this small scale is to share the work as much as possible. In theory it may not be so efficient as a greater

division of labour but we find it more companionable and stimulating.

Correspondence—Sale or Return Agencies

The next morning whilst David was cleaning up I attended to the correspondence as usual. Amongst the letters were two which are worth mentioning. One informed us that an agent from whom we have had great difficulty in obtaining payments for some time, and who had of late refused to reply to letters, was bankrupt, and that apparently her stock of our pots on 'sale or return' had been sold with her other assets to pay off creditors! About £20 to be written off as a bad debt I'm afraid.

Distribution

I am glad we have made the decision to abandon 'sale or return' agencies in favour of purchase outright. They have rarely been satisfactory. The temptation for someone setting up one of the innumerable craft shops is to furnish them inexpensively in this way, and the inducement is to sell cheaper goods which they have had to buy outright. The first difficulty, of course, for small scale production is to find a way of making a sufficient number of similar articles to sell at a low enough price without losing quality. The second is to discover a method of bringing one's work to the notice of people who are potentially interested in it. That there is a public for good work is proved by a few shops and galleries where it is shown with taste and the customers are treated in a businesslike way. In spite of the miserable hand-made junk, both old and new, with which most of the craft shops of England are filled, their number shows that a well-intentioned but ill-directed desire for humanly expressive work is widespread. 'One man shows' in London are too expensive to be depended upon for bread and butter. One way and another they cost at least £70, which makes the sale of inexpensive articles unprofitable. Selling by means of illustrated catalogues presupposes exact repetition in quantities

contrary to the intention and capacity of individual handwork. Therefore it would seem that a different kind of distribution is needed by the hand craftsman in a machine age. The best method we have found is to take a box of samples out in a light car once or twice a year and be one's own traveller. By this means we can sell outright, keep in touch with agencies, and obtain a truer understanding of the extent to which the public will buy pots which are primarily made for their own sake.

The other letter was from Japan. I think the following passages will interest you.

ANDO MURA,
YAMATO,
JAPAN.
March.

Dear L.

How your family and your work getting on?

Nearly every day we talk about you but it is too far Yamato and St. Ives. . . . Here Ume no hana (plum blossom) gone, Ūguizu (nightingale) came, Haru no tsukai (harbinger of spring). I think you remember this best season of Japan.

This year I had five kilns but only five good works (not *good*, ordinary) and we wish to break up all the others (50), but if we break up all of them we must ask 100 yen (£10) each for five works. Then who will buy? Can they buy? Well if they cannot buy how shall we live? Think! only five pots out of 100 pots, two months hard work, 150 yen gone. I will stop; you know well.

Plum blossom, nightingale and the rain of Yamato—poor, but we enjoy so much. I feel the plum blossom and such kind of flower deeply coming in to my mind year by year. Last year I did not feel as I enjoy this year.

I wish to speak with you in the quiet room but I cannot explain well. Bah! English!

Pease write to us.

Yours,
Kenkichi Tomimoto.

Opening Clays with Grog or Sand

For the large pots I added to the same stoneware body a one-to-four proportion of fine grog. This Stourbridge fireclay contains particles of iron oxide which fuse under a glaze and cause flecks of dark brown or rust red to appear in its surface, breaking the uniform tone pleasantly besides opening the smooth texture of the stoneware clay. When this mottled effect is undesirable we use local red siliceous sand in which the iron is more evenly distributed.

Next we cleaned out the two wheels, taking the accumulated clay shavings and putting them to resoften in buckets half filled with water, then the bearings were greased, the throwing tools checked over, and bats and boards for the pots set out. The workshop contains well over 100 cleated boards three feet long and either six or nine inches wide. Brackets and cupboards are made to fit these standard sizes. In more spacious potteries longer shelves are generally used.

During the afternoon I made some thirty bowls and jars, the former between ten and twelve inches in width and the latter anything up to fifteen inches in height, and all thrown in one piece.

Impromptu Throwing and Drawing of Pots

These pots were mostly impromptu but I do depend upon drawings done at all sorts of odd moments when an idea of shape or pattern leaps to a visual image. Of these I have kept some hundreds in a drawer ever since I first began to make pots, destroying those which cease to ring true, and adding new ones from time to time.

Throwing Speed

After weighing out his clay into 6-oz. balls David made his sixty ash pots, from a model, in a couple of hours—slow enough compared to the pot a minute of the professional thrower here

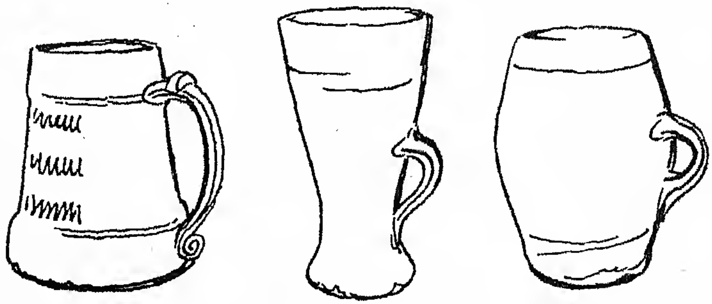
or in the East, but not so fast as to destroy sensibility to form. Students, on the other hand, are apt to forget that the hollow clay shape on a potter's wheel is in a semi-fluid state and that each touch or pressure to some extent affects the whole form. Also that it is continually becoming wetter and softer, and that therefore a well thrown pot can only be made during a very few minutes.

Saggar Making

Saggar clay is harsh on the hands so we use pads of wet rag instead of the direct pressure of the fingers. When the saggar is not to be more than six inches high, instead of coiling we place the ball on a round wooden bat and centre it by beating with the *dry* hand and then slowly and rhythmically thumping out a cavity with the fist from the middle to the required diameter. The thick outer ridge is then wetted and thrown up to the required height in the usual way. On the inside the bottom is smoothed with a broad wooden rib. A thin brass wire held tight to the surface of the bat is then dragged right through the clay. David also made a dozen saggar tops by beating out the clay on sanded bats and trimming them off on the wheel with turning tools. I should add that he had made a couple of tall saggars without bottoms, cylinders in fact, and cut them horizontally with a needle half way up the wall as they revolved, thus producing altogether four rings which are sometimes used for heightening saggars to contain tall pots. These cylinders were about ten inches high and twelve inches in diameter, which is rather a strain for one person to draw up whilst propelling the kick bar, so I stood by his wheel and did this donkey-work whilst he threw.

On Thursday morning, after routine, the previous day's pots were examined and turned upside down to enable the thick bottoms to dry more evenly. Then I continued to make new shapes whilst David, after cleaning out the saggar clay remnants from his wheel and kneading up the necessary clay, set to work

on a couple of dozen of our standard pint jugs, and the same quantity of half-pint beer mugs. I enclose drawings of the



Position and attachment of handles

latter so that you will be able to visualize one or two points which will come up later. These shapes have been evolved gradually and are neither individual nor purely traditional.

Co-operative Pots

There is a peculiar satisfaction in arriving at a unanimous verdict about a shape and its decoration. We rarely copy old designs, partly because they seldom conform to present day use, but mainly because the spirit of to-day has a different tempo and rhythm, nevertheless we have no objection to taking hints from anywhere providing the resulting pots have a use and life of their own. As Yanagi said in one of his letters: 'we enjoy those pots most which are born and not made.' My criticism of most studio-made pots is that they are made and not born. Amongst my own pots the one which gave me most satisfaction was this teapot engraved with a chisel-headed bamboo tool whilst it was still on the wheel. An olive-blue glaze should fill the recessions and smooth the sharp edges, and, with luck, will come out a burnt brown where the glaze runs thinner and the iron in the clay adds its quota to the iron in the glaze (See Plate 42).

Turning and Decorating combined with Throwing

Some of the pots were thrown with balls of somewhat stiffer clay, making it possible to shave the lower and thicker portions at the last stage of throwing. In such cases the foot is not hollowed out and depends for its character upon the cut of the twisted gut or wire. This directness gives a greater degree of unity of form to large pieces besides increasing the speed of production. Included in this category were several narrow-necked bottles akin to those of the Sung dynasty. They make a particular appeal to a potter because they are very complete abstract shapes and can be effectively used as vases for single sprays of flowers, for dead grasses or thistles, branches of lichened thorn or willow catkin (See Plate 33).

Stacked Glost Wares

I also made six cake dishes to be packed in a pile only separated by small balls of quartz sand mixed with a little flour paste. The flour burns out leaving the friable grains of sand loosely held together which can easily be chipped off with comparatively little blemish to a thin glaze. This is not a method which can be indiscriminately recommended for fine table ware, although it is one which is extensively used in the East. The stilts, spurs and thimbles ordinarily employed for lower temperature glost firings are out of the question for stoneware and porcelain, because they would throw the pots out of shape and make deep scars in a softening body.

Turning, Fettling, and Decorating Green-hard Pots

During the afternoon we both gave attention to those pots made earlier in the week, now sufficiently hard to handle without going out of shape. Smoothing the angle of the feet of those which did not require shaving with the ball of the thumb, stamping them all with the pottery seal, and individual pieces with our private marks, and then beginning to turn the others

on chucks fixed to the head of the wheel. I could not get finished by tea-time so I worked alone for a couple of hours in the evening as I saw that there was plenty to do on Saturday morning and we were anxious to have a break that afternoon. Turning takes nearly as long as throwing, but neither can be done quickly when it is a case of searching out new form. When engraving, tooling, seal rolling or stamping has to be done at the same stage, time has a way of stopping. Every cut of a turning tool has as much possibility of clean or smothered action as each pressure of the hands when throwing, and it is not a question of a mechanically perfect profile in either case, expression is constantly aided or thwarted by the hardness and texture of the clay, the sharpness of the tool, and most of all by that rare balance of true feeling, planning, and the deft hand.

Saint Ives pottery seals

Pottery Visitors

On Saturday mornings we allow visitors to watch pots being made, so that not much beyond finishing up the week's work can be accomplished. We have often argued that it was troublesome and unprofitable, but we have gone on doing it because it has given us a means of keeping in touch with the public. All sorts come in, a fair cross-section of the kind of people from whom we must earn a living, some appreciative, mostly uninformed about the a b c of pottery making, but nearly all sincerely interested when they see pots being actually made by simple handwork which they can grasp. Many have said to me, 'I shall never look at a pot in the same way again,' and that, more than any resulting sales, has made us feel that it was worth while. Yesterday we had a good bunch of people, two of whom at least knew a good pot when they saw it. One woman started by asking if we hadn't got any 'blue pots', and when David showed them that last olive-blue glaze for which we have

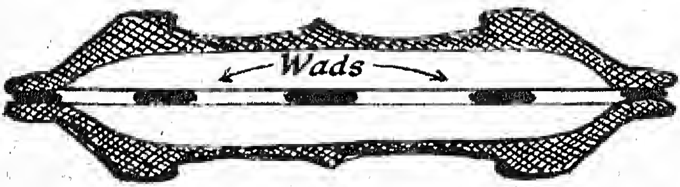
experimented for years, she said: 'Oh! do you call that blue? No, I want something bright to give to my niece for a wedding present. If you haven't got blue, orange or green might do.'

Eventually, when she had seen how well a celadon can display many flowers by quiet contrast, she asked me to make her a vase specially for roses which I proceeded to do forthwith whilst she watched. £4 odd in sales for the morning, £15 for the week.

At 12 o'clock we closed the pottery and put away in the damp cupboard all the pots which were in any danger of getting too dry before they could be slipped or raw glazed on Monday.

Mutual Criticism

Whilst doing this a mutual flow of criticism about the week's work went on. I found fault with the ribbing, naturally caused by finger pressure when drawing up clay on a wheel, on the pint jugs which David had thrown the day before.[1] I felt that the accent should be more on the major curve than on the straight line to the lip—a smooth curve and a ripple above



Unglazed lips
Plates packed lip to unglazed lip

having less vigour because the eye was distracted thereby from the main expression of the shape, and also because it indicated a disturbed rhythm in the actual throwing. David agreed, but questioned the lack of a regular foot on the base of my cake dishes. I pointed out that, as can be seen in section, it was important to reserve an ample thickness of clay to thrust obliquely outward towards the lip so as to counteract the additional ten-

[1] Plate 23.

dency to sag due to the dishes being piled one upon another. He replied that the argument was not a sufficient defence of an uninteresting shape.

II. *Sunday, September* 14, 193—

DEAR X,

I hope that this letter will be briefer than last Sunday's, at any rate I intend to avoid repeating descriptions, even at the risk of understating the necessary but monotonous side of pottery. The small scale potter has half a dozen vocations rolled into one—sculptor, painter, bricklayer, carpenter, fireman, tradesman—and each one of these activities leaves a mess to be cleaned up!

Over-fast Drying

On Monday, despite precautions, we found that some of the pots had changed colour on the thin edges because of the dry east wind outside, so we had to damp them down again by light sponging before we could dip them in slip or glaze. If this is not done they are apt to split, and also to bubble, as the glaze-water soaks into the open pores and displaces the little pockets of air.

Slip Gauge

It was not sufficient to mix up the white slip with a paddle as it had coagulated into small lumps, so we ran it through a 60-mesh sieve into another tub, and then tested it and the black slip with our slip gauge, which is simply a painted wooden rod marked off in half inches, with a weight at the end. This floats vertically in any liquid, but at different levels according to specific gravity. When we have found out from experience that the quantity of water in a glaze, or more particularly a slip, is just about right we note the figure to which the gauge sinks and can repeat the process at any time without trouble. David

now began to put handles to the jugs and beer mugs whilst I slipped my pots.

Slip Treatment

Most of them were dipped, either to provide a light toned base for subsequent glazes or for sgraffito. One or two jars I combed, as soon as the surface of the slipped pot began to lose its shininess, with a bluntly toothed comb made out of a piece of old car tyre.[1] As they were large pots, this was done after centring them on a wheel on a round wooden bat. Sgraffito designs are inclined to be dry and wiry, so I have taken to using a fast 'running hand', as the Chinese call it, supplemented with broad strokes and touches of brushwork in iron pigment. This is made up simply of one part of magnetic, or spangled, iron and one part of white slip, and resists a high temperature without blurring. If I were a sufficient master of the brush I could no doubt obtain the sharp contrast of broad and fine strokes with the freedom of an Oriental, but I am tied racially to the carved line of European tradition, and all I can hope to do is to use it with freedom and introduce the broad feather weight of the brush with discretion.

Cut Paper Pattern

For the cake dishes I cut three round sheets of Japanese paper into this mountain and path pattern and pressed the positives to the dampened clay and then dipped the whole dish into white slip. Then the three negatives of the pattern were treated in the same way and the plates immersed in black slip. After a short time the paper was carefully peeled off exposing the natural colour of the body in contrast to the slipped areas. The trees were added with a trailer containing black slip for the first set and white for the second. Finally, a few details in the house and the peasant's figure were engraved when the pieces

[1] See p. 115.

had sufficiently hardened. By these simple means quite a rich counterpoint of line and tone was produced which could not have been obtained in any other way. A further advantage is that such a form of decoration can be applied by several people working together without loss of character. This work took up all my morning (See Plate 59).

Pulled Handles (See page 224)

Meanwhile David had finished his handles and he asked me to run my eye over them. Both of them, as you can see, are unusual because they are applied amidships: this treatment, as the jug exemplifies, generally necessitates an extra protuberance which is, as it were, against the rules, but if the handle were attached at or near the lip, which is the usual practice, it would have to be much thinner to avoid pulling the mouth out of shape, both when it was being rammed home and also as it contracted. Moreover, the danger of breakage would be increased rather than lessened. Another advantage of this type of handle, and it frequently applies to teacups, is that the purchase of the hand, or forefinger and thumb in the case of small articles, is near the centre of gravity and the action of pouring or drinking is facilitated. As it was, some of David's handles were inclined to be thin and tapering. These are both bad faults, the first is an offence against the implicit plastic demand of any generous shape, and the second, a narrowing of the width of a handle from top to bottom, also takes away from the breadth of form in a quite peculiar manner. Handles, spouts and knobs are all tell-tale adjuncts of pots, and modern potters seem to go astray as much as modern builders with their porticos, finials, facia-boards and chimneys. A round sectioned handle is almost equally objectionable from opposite reasons of clumsiness and weight. Such rotundity may take its place in early pottery, but it does not suit modern life. Sophistication is our lot and not necessarily a bad thing, so we seek a solution in the matter of handles by a flat oval section and springing curves. There are

two ways of considering handles, as there are of all compositional problems, one of which may be called positive and the other negative. The former I have been dealing with, the latter is more subtle. I suggest an approach to it by a consideration of the empty spaces which are formed by the handle, chiefly the aperture for the fingers. It may seem a roundabout way of dealing with a practical problem and yet I know of no such effective means of discovering the precise curvature which would give the greatest degree of satisfaction in use.

After lunch I mixed up two raw glazes ready for use. One was the 'tenmoku' which came out so well on a few pieces in the last firing, and the other was an ochre celadon. Into the tenmoku I dipped several large jars and bowls and the bottles, and made a pattern by cutting away the glaze with a broad flat point as soon as the surface had set. The glaze is applied thickly and the best effect is obtained by a high temperature, so there is some risk of flow. For this reason a broad line is less likely to be lost and displays the heavy droop of a fat glaze. The effect is richer and looser if a wax resist is employed instead of an engraved line. When such pots are fired in the open, and particularly with a well oxidized finish, even the unglazed parts become thinly glazed by the action of the naked flame, and the iron in the clay flashes to red or brown.

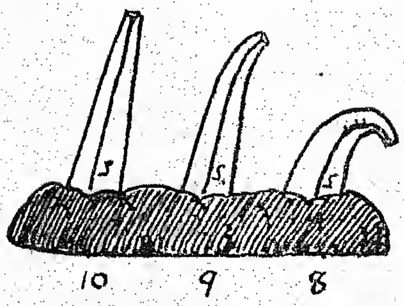
This tenmoku glaze is made of two parts of our Korean type of celadon and one part of what is known hereabouts as tin slime. It is the crushed and levigated ore from which most of the tin has been extracted. There are quantities of it about near tin mines and 'stamps' forming brown banks of a fine earthy powder. The colouring agent is mainly iron. We have never had ours properly analysed as there was no point in doing so since we could always obtain further supplies. The celadon composition is given on p. 166 and depends for its quality to a large extent upon the ochre which we get in the St Erth Valley. This glaze can be applied either to a raw or a biscuited body. The iron flecks, mentioned earlier, come out very well under it and

our purplish-brown manganese glaze makes a very pleasant foil when trailed like a slip over it. Another means of decoration I employed this time, derived from Hamada,[1] consisted in painting a pattern on raw celadon glaze with wax resist and then basting the whole surface with a broad flat brush loaded with a thin wash of magnetic iron. The pigment in turn is covered with a further brushing of celadon, so that it lies between two layers of glaze. The iron, or any other pigment, can either be sprayed on or, alternatively, the pot may be dipped. Painting can be done over a sluggish glaze if it is not too friable and if some flux (usually the glaze itself in a proportion of 1 to 3) is added to the pigment to subdue a metallic incrustation on the fired surface.

In the afternoon David wanted to make some of his own pots for a change, so after I had finished glazing I kneaded up a quantity of porcelain clay with 10 per cent. of our plastic ochre to form a fine celadon body suitable for delicate articles. With this I made samples for two tea-sets for which one or two old customers have been clamouring for a long while. Porcelain, smooth though it is, is hard on the hands, so we keep a pot of ointment handy to rub in after a spell of throwing.

Cones

The following morning, Tuesday, I sent off an order to Wengers for Seger cones, both the standard and small test kiln size: cone 1 (1100° C.), cone 7 (1230° C.), and cone 8 (1250° C.) which we use up quickest, generally setting these three in a wad of clay opposite a spy hole. Cone 1 is used to indicate the period when

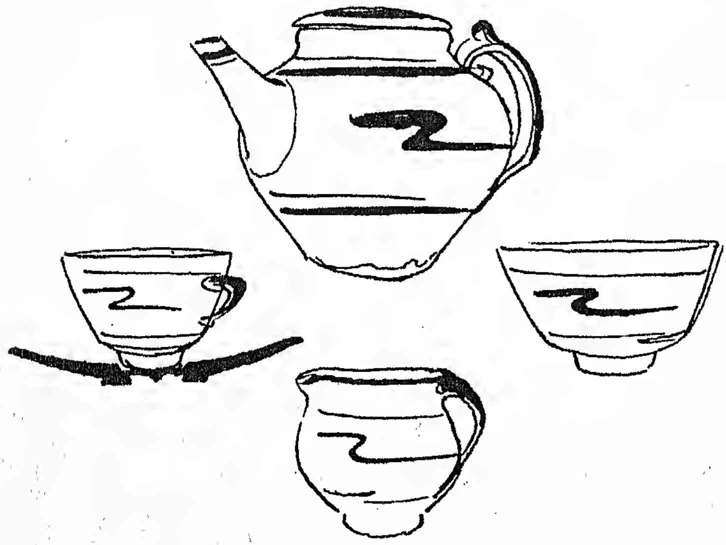


Seger cones

[1] See Plate 70.

reduction should take place as it bends over at about 1100° C. before the glazes begin to flux. Cone 8 is our average, or middle temperature, though we have glazes which mature at cone 7 and up to cones 10 or 11, and this represents the normal variation from back to front of the kiln.

During this day I finished the pots thrown on Saturday morning and made some twenty-five smaller pieces of celadon including three teapots with their separately thrown spouts and lids. Whilst I was doing this work David made the remainder

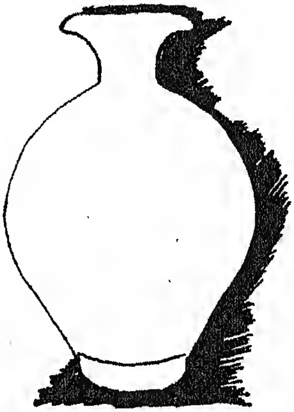


Design for a tea-set by the author

of the cups, saucers, small plates, milk jugs and slop bowls from the samples I had thrown the previous night. The next morning his own pots had hardened sufficiently, so he worked at them most of the day turning and decorating. Amongst them were one or two pots which had been worrying me considerably as I caught a glimpse of them out of the tail of my eye. Whilst he was turning their feet I saw that he had some uncertainty about them himself, and when he began to mess about with a

lot of pattern, as it were to smother their weakness of form, I expostulated, but he turned on me, brush in hand, and pointing to one of my own pots, asked me angrily if I thought it was any better. I paused, looked at it afresh, saw that it had a lifeless main curve which sagged to the foot, picked it up and threw it

Pseudo-Greek vase



Sino-Greek vase

amongst the slops. He laughed, and was about to do the same thing with his own when I stopped him in order to make an explanatory drawing of a vase, which I enclose.

Greek and Chinese Influences

As a vase it is as practical as the one which I have drawn on the right, but its shape is derived from our pseudo-Greek tradition and the middle and late Greeks were bad potters.[1] My criticism of this pot is that it is conceived coldly and without reference to

[1] Michael Cardew, writing of what he calls the 'Greek vase horizon', says: 'In even the best examples the *pot itself* is degraded to be a mere field for the drawing; and however good the drawing may be, the pot fails as a pot for that reason. Made by the labour of slaves or of an artisan class explicitly held in contempt by Plato and Aristotle, who despised handicraft as a servile, vulgar and somewhat disgraceful occupation, they are, in their own sphere, typical products of the age which saw the birth of logic and philosophy as we understand them, an age in which Greek intellectualism stifled Greek art.'

its material and to the organic growth of spinning clay shaped by human hands. It is devoid of the active rhythm of the North, of Viking ornament, of Gothic gargoyles. The lip is thin, the foot metallic—a pale derivative of classic elegance. The vase which I have drawn may be equally derivative from a Greek source through T'ang assimilation, but it is a better pot.

Summer Courses for Teachers and Students

On Thursday morning came an enquiry from two school teachers who wanted to know if we gave a pottery course for students in the holidays. I replied that we did in the summer and sometimes at Easter, and gave the conditions. We have had some interesting spells of work with small groups working together for two or three weeks. They at least obtain some first-hand experience to take back to schools, and always seem to enjoy the varied life of a pottery. It is only a smattering which can be obtained in so short a time, one to three years is necessary for a training, and I find that that is best learned which is not taught but imbibed or picked up almost unconsciously in the natural course of co-operative work. Many of these students, upon whom the teaching in schools depends, and by whom the attitude of the next generation towards crafts will largely be formed, have had a little previous experience, but this is usually a disadvantage, and we often conjecture what sort of teaching of pottery goes on under the mantle of the Board of Education and wonder how it could be improved. Without a standard of values it is problematic whether nine-tenths of it is of any use at all.

Tile Dipping

This morning I asked David to dip one hundred 4 by 4 inch fireclay tiles, which Pearsons of Stourbridge make for us, in white slip. This simple process has to be done carefully. The tiles should be thoroughly clean, otherwise pin-holes appear after dipping where dust prevents the slip from adhering pro-

perly. The clay being coarse there may also be small pockets in its surface which do not become filled; in that case it is advisable to dip the tiles, or pots for that matter, lightly in water a short time before they are to be slipped. The tiles are held one in each hand face downwards, and immersed $\frac{1}{8}$ inch one after the other, lifted smartly an inch or two and returned to catch the wave of slip caused by the suction. They are then tilted at an oblique angle to let the surplus drain off. If this is not done quickly a star pattern of extra thick slip, which may not become visible until after a glost firing, will be formed. Tile dipping did not take long and was followed by the making of a hundred test rings.

Rolls of Clay

They were rolled, flattened, cut into lengths and looped in less than three-quarters of an hour. The knack of rolling a lump of clay between the palms of the hands in such a way that an even string, or rope, of clay is rapidly extruded downward is one of the numerous sleights of hand of which a potter should be master. It is a survival from primitive coiled pottery, which is still of use in a dozen different ways as, for example, the wadding of saggars.

Clay Slices for Moulds

After the rings David cut some oval slices of a mixture of fireclay and stoneware to be pressed the following day on a large plaster mould of a meat dish. Such slices are spread out singly on wooden bats, unless it is necessary to keep them for some days before use, in which case they can be piled six deep and covered with a damp cloth. Should they become too hard to bend without splitting they may be laid out singly on saturated plaster, such as the bottom of the damp cupboard, and again covered over with wet cloths. By this means slices of clay, or even pots, can be re-softened in a few hours. Whilst this work was progressing I had been turning and completing the

ochre-porcelain shapes thrown on Tuesday, and when David had finished he began shaving the feet of his cups and saucers. The turning, handling, spouting, slipping and decoration took us both well into Friday afternoon. Three teapots alone took as much time as half a dozen large jars which would sell for more than two complete tea-sets. The last job was pressing the slices of clay on the moulds, trimming the edges and modelling the feet. By four o'clock all the pots were ready for drying which, since the weather was good, we left to take place naturally.

Painting Tiles

The last two hours of that day I gave over to painting slipped tiles. Our stock was getting low in certain patterns, and I wanted besides to work out a new design by repeated painting until I discovered a final simplification of brush-strokes and spacing. The subject was simply a robin picking up crumbs.[1] With a speculative eye I have watched David feeding it after lunch for weeks and I wanted to find twenty broad and fine touches of iron pigment and a pale wash of Chinese cobalt to express what I felt in less than two minutes. The repetition of such patterns on pots is not necessarily the boring work which might be supposed, provided some freedom of interpretation is permitted. Although the composition is predetermined, and even the order of the strokes more or less fixed, mood and its consequent rhythm alters from day to day and even from pot to pot, so that the verve or intensity with which it can be set in motion provides a constant incentive to a pattern-painter. Being human one has 'off' days, and there are also times when the desire to make new patterns is thwarted by orders for old ones illustrated in a tile catalogue.

On Saturday we still had a few visitors but most of the summer holiday-makers have gone and our local sales will almost come to a standstill until next Easter. The week's takings dropped to £8 odd.

[1] See Plate 68.

III. *Sunday, September* 21, 193—

Biscuit Firing

DEAR X,

It is not our habit to have special biscuit firings because the second chamber of our kiln is constructed so that the flow of heat from chamber I can be diverted to the chimney by dampers as soon as chamber II has reached biscuit temperature. Without this precaution it would normally go up to about 1000° C. From that point, when we wish to use it for stoneware, it has to be side-stoked with wood. That is our intention this month in order to obtain oxidized effects upon the pots biscuited during August. The chamber holds about 150 pieces which will be additional to our normal monthly production. To fire the second chamber alone it has to be started up from cold with gentle baitings of wood fed through the lower stoking holes at each side. Any dry wood, or even coke or coal, may be used during the first part of the firing, but a light and resinous deal or pine is requisite during the later stages to give a long well-distributed flame.

The Biscuit Firing

By Tuesday evening the pots were nearly all dry, but to make doubly sure we put the larger pieces, and those which had been made last, into the drying cupboard where an oil lamp could give them a gentle heat all night.[1] The pots may be piled upon one another almost indiscriminately. In this case the shelves presented no difficulties. In front of them the saggars and larger pots were placed at the bottom and the smaller and thinner pots

[1] The drying and damp cupboards are light wooden frames 18 inches deep, 6 feet high and 3 feet wide covered with sheets of asbestos. The damp cupboard has 3 inches of saturated plaster at the bottom to maintain humidity, and the drying cupboard is perforated on top. Both are fitted with runners at intervals on which the boards slide home.

on top with a loose wall made of old shelves eighteen inches high between them and the fiercest of the flames. At the sides a gap of two inches was left to allow some of the heat to traverse the inside of the cold doorways. Cones and tests were quite unnecessary because it is only a question of attaining a low red heat all through and this can be perfectly well judged by eye. Each entry is formed of eighteen large fireclay blocks, made by ourselves to fit the space exactly. This saves a lot of work which is exceedingly hard on the hands. Mud and sand with a little waste clay added was trowelled over the outside and the whole surface was brushed over several times during the firing to make sure that no fine cracks would allow cold air to dunt the pots within.

The firing was started at one o'clock with a couple of pieces of wood $3 \times 2 \times 24$ inches burning on each wing pushed gradually into the lower holes. The flues from chamber I had previously been closed with firebrick and slurry to shut out draught from that direction. The reason for this was simply the inconvenience of closing the flues at the back of the shelves in chamber I. Flames never exceeding two feet in length were kept up by fresh introduction of wood every ten minutes or quarter-of-an-hour for two hours. In the third hour the quantity was slowly increased, the intervals shortened, and the flame lengthened to about three feet. By the end of the fourth hour four pieces of wood $2 \times 2 \times 24$ inches were pushed in on either side every eight minutes or so and the flames could be seen climbing to the top of the wall. This is the time when any pots with thick sides or bottoms are most likely to burst, and if this should occur the only thing to do is to slacken off the rising heat for half an hour, or more if necessary. Once the flames have begun to give the nearest pots a dark red hue the danger is over and the last stage of stoking is reached. From this point six pieces of wood, averaging only $1 \times 1 \times 24$ inches, were inserted at a time from each of the upper stoke-holes at intervals of four minutes when the wood had died down almost to ember.

At the end of the fifth hour the whole mass of pots was a dull red. We closed the four stoke-holes and clammed them up and gave a last basting over the doors with slurry, cleared up and went to supper.

White Matt and Chün, or Yüan, Glazes

Earlier in the week the biscuited pots for the second chamber had been glazed and decorated. Besides the rust and black glazes already mentioned, sometimes used over one another with wax reserve between, the only other glaze we used was white matt containing bracken ash.[1] The old Chinese used to burn bracken and limestone together to make a flux for their porcelain glazes. We use it because it contains a high percentage of alumina and magnesia, and gives the thick glaze a smooth-surfaced opacity pleasing in itself and equally suitable for either wax-resist or over-glaze painting. It is kin to the Yüan or Chün glazes in which rice-straw ash takes the place of bracken. The rice-straw ash contains 30 per cent. more silica than the bracken, and less alumina and magnesia, and it is the suspension of tiny particles of silica in the melted semi-translucency of the glaze which produces its opalescence. As in some celadons the bluish colour is due to a small percentage of iron in both glaze and body. It is a mistake to attribute the Chün blue to the presence of oxidized copper. Hitherto we have found the best substitute for rice-straw to be the common thatching reed which grows on marshy land. Attempts to replace the silica of vegetable origin by quartz or flint have not been successful, because they are not as intimately combined with the other ingredients of the glaze.

Test Glazes

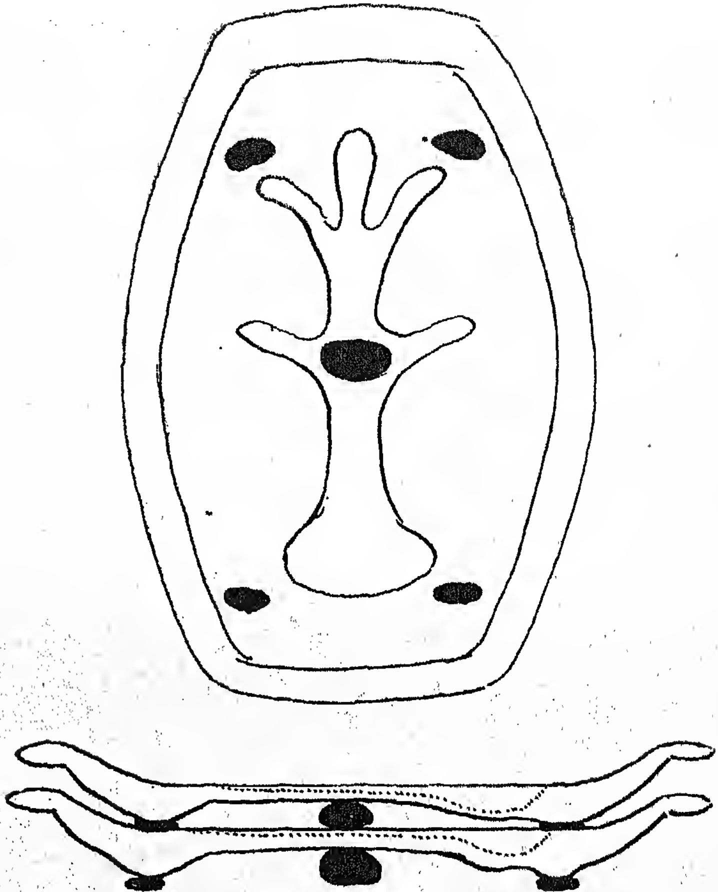
On the Tuesday afternoon I had prepared two glaze experiments to be fired in the little test-kiln during Wednesday's biscuit

[1] See p. 173.

kiln. Our tub of ordinary stoneware glaze was getting low, and before making up a fresh batch it was prudent to try out a small quantity using the new washing of hard-wood ash. This is a mixture of oak and elm obtained locally as sawdust and burnt by us. The other experiment consisted in using plain feldspar mixed with 10 per cent. of the same ash, approximately the glaze composition used in the old 'Hagi' ware of Japan. Both tests came out well although not first-rate in quality, which is hardly to be expected, as it is far from easy to control the atmosphere of the fierce flame of a blow-lamp constricted within a narrow tube. But the results told us what we needed to know, namely, that the fluxing power of the ash was normal and that it did not contain any harmful impurities. The ash and feldspar applied thinly over a mixture of red sand and stoneware body and then irregularly a second time with a thicker coating of the same glaze yielded an effect resembling 'Hagi', 'Karatsu', 'Oribe' and 'Shino', rough and smooth at one and the same time, reminiscent of the thawing surface of frozen snow. If magnetic iron is used as a pigment it almost disappears under the thicker patches, shows as a dark earth brown elsewhere, and emerges as a burnt red rust through the thinnest parts, enhancing thereby the wintry effects in which the Japanese delight. The firing may be oxidized or reduced, but the finish ought to be oxidized to bring out the warm tones of iron in body and pigment.

Moulded Oval Plates

Whilst I was carefully weighing out, mixing, and making notes of these tests, David pressed and fettled the six meat dishes. You will notice that the feet are formed by knobs at the four corners. We decided that such treatment was safe because the weight of the piled pots would be well distributed and there would be less likelihood of warping. We planned to leave the grooves in the middle unglazed and use them during the glost firing as a base for a central prop. The gravy trough in which



Joint dish and method of stacking

the grooves terminate forms a protuberance underneath slightly shallower than the feet. These plates were all dipped in our raw 'kaki' glaze.

Crude Oil

During Wednesday we recollected that our supply of crude oil for the next week's firing was getting low so we telephoned

for another delivery of 100 gallons at 6d. a gallon. On Thursday morning, as the kiln was still rather too hot to open, we made 'snakes' and biscuits and put them away in the damp cupboard. Then we both set to work weighing and sieving the ingredients of the standard stoneware glaze, making up a quantity of half-a-hundredweight (dry), enough to refill our tub.

Unpacking the Biscuit

In the afternoon we unpacked the biscuit. A few handles were sprung at the hilts because the pots themselves had been allowed to dry too far before the handles were attached, and, unfortunately, one or two of my large pots had cracks in the bases. This was due to lack of care on my part. I had got so much into the habit of throwing with the intention of hollowing out by turning that I had not made an allowance for the fact that some of these pots were not going to be turned. It is almost impossible to mend such cracks, because the shrinkage of the clay opens them out still further during the subsequent hard firing. The handles were not so bad that the cracks could not be filled with a paste made of waterglass and dry clay and then covered by an extra touch of glaze. The dusting and sorting of the pots according to the glaze or pigment treatment which they had to receive occupied the rest of that day. On Friday the excess of water in the new glaze was decanted, and the rest of the week was spent in decorating pots.

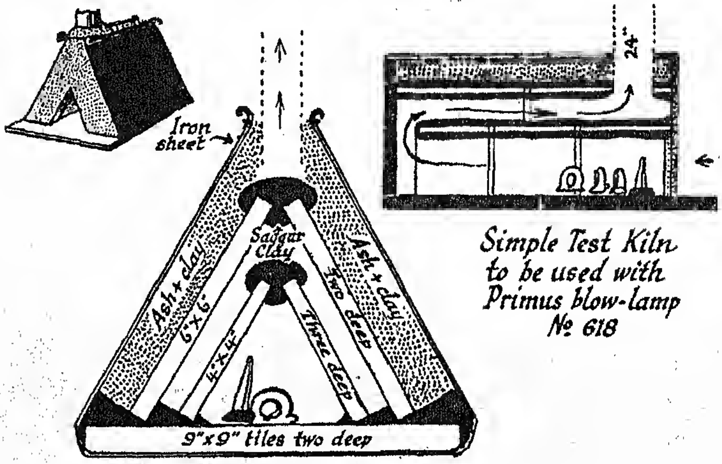
IV. *Sunday, September 28, 193—*

DEAR X,

The firing is over and it has made up for August's losses, but before I attempt to describe this last week's work I must answer your question. You ask how the test firing was done.

Test Kiln

I am sorry I omitted a description of the little kiln. Here are three drawings of it. Firing from cold takes about three-quarters of an hour to reach cone 8 and is a normal firing on a miniature scale. Towards the end the outsize blowlamp[1] has to be pumped frequently to keep up a maximum pressure. The paraffin container two-thirds full may give out towards the end, in which



Simple Test Kiln to be used with Primus blow-lamp № 618

case it ought to be filled and re-pumped very rapidly to avoid dropping the kiln temperature, and it will then re-light in position. Its full blast is deafening, but for this there is no remedy. A second or third firing will be proportionately far shorter; before now, we have obtained stoneware temperature in ten minutes. These blowers are very strongly made and will last for years. The best filtered paraffin should be used to avoid dirt, which easily clogs the tiny jet. In any case it is advisable to keep the pricker handy, and there is no need to stop the firing in order to use it. If the container is more than two-thirds full, burning liquid instead of paraffin gas will spurt out.

[1] Primus blowlamp No. 618.

Stoneware Glazing and Re-glazing

On Monday the first job was to stir, and sieve when necessary, ten tubs of glazes. Some of them have an inclination to settle or coagulate more than others, usually those which contain most silica and Cornish stone settle, and those with a large proportion of raw plastic clay coagulate. Certain ashes, like bracken, and oxides such as manganese, cause the soggy mass of settled glaze to consolidate in a particularly obstinate manner. In order to break this up, the blade of the dolly should alternately chop the surface and rotate over it, mixing with water the glaze which has been displaced by the vertical action before repeating the process. Much time and temper can be saved in this way.

There are generally a few underfired pots left over from previous kilns which require a touch or two of thick glaze where the original coat has chipped or bubbled off. Sometimes bubbles have to be ground down to a smooth surface with carborundum, and in other cases it is possible to save a good shape by re-dipping it in an opaque glaze to cover the original colour or pattern. Such pots may have to be pre-heated as they are practically non-absorbent, and in any case the consistency of the glaze must be thick. That is why it is better to do this work before the glazes are thinned out with water for normal dipping. It is also possible to make a thick glaze adhere by brushing the pots over with a thin coat of size and letting the surface dry before re-dipping.

After lunch David began packing chamber II while I glazed, trimmed, and decorated by glaze over glaze methods which I have already described. By 9 p.m. we had finished.

Stoneware packing

On Tuesday morning the pots for reduction in chamber I were divided up. Those for the 4, 6, 8, and 10-inch shelves, and tall pots for the top, were ranked near the kiln door,

whilst the wide pots were congregated near the saggars. Then subdivisions were made of those glazes which required most or least heat. From this stage packing continued steadily all day, one of us filling the shelves from top to bottom, and the other feeding suitable pots, biscuits and tools, and during intervals packing bungs, eighteen inches high, of saggars ready to pile in front of the shelves when they were finished. This month there were few interruptions and, save for one disconcerting accident, the work went smoothly, but it was late in the afternoon before the shelves were full. It is worth mentioning what happened, as a warning. A shelf full of pots had been put on a rather narrow box so that it projected at one end. Pots were taken from it by degrees until I asked David to give me a tall one from the far end, and as he turned and seized it, the weight of the rest suddenly proved too much, and the whole board toppled over and several pots were broken.

Packing fragile and friable pots close together by the light of guttering candles[1] stuck in lumps of soft clay against the walls of a kiln, cramped, dusty and often cold, calls for much patience. By the time one gets to the bottom shelves, either kneeling on a pad, or lying prostrate on the flues working sideways trying to put round pots into square holes, one is tired. From 7 p.m. till 10 p.m. we built up four bungs of 10½ inch, and one central pile of 13 inch saggars, each touching the next, and forming a wall with a 2½-inch gap at either side to allow a passage of flame to the cold wings. On the top were the open fired bottles and jars rising to within a few inches of the crown of the arch, and in the very front of all we made a buttress of old bats eighteen inches high to protect the lowest saggars from the brunt of the heat. Eventually, by close on midnight the doorway was blocked up and clammed, the blow-holes opened to let off steam from the raw clay, and the iron framework

[1] A small electric light on a lead, protected by a wire cage, may be used in preference if current is available.

put in position and screwed moderately tight to prevent lateral expansion.

Stoneware Oil Firing

Then we lit up a slow fire to burn unattended all night. This was done by inserting a short length of ½-inch iron pipe through a small hole above the main fire-mouth, through which a steady drip of paraffin could fall at the rate of one drop per second on to a thick log beneath. To the iron pipe was attached a rubber hose with a funnel inserted at the other end which led to a five-gallon tank with a regulating tap. This fuel gave a flame about twelve inches long, sufficient to warm up the whole kiln and chimney by the next morning.

You are already familiar with our former wood firing of this kiln, so it may interest you to hear what we have done to make the change over to atomized oil, and the results obtained. Some structural alterations to the fire-mouth, furnace or combustion chamber, and to the flues leading into chamber I have had to be made. The fire-mouth has been reduced in size from 150 square inches to 16 square inches to suit the narrow flame of blown oil instead of logs, and the firebars and ash pit have been abolished.[1] In their place a wedge of firebrick has been constructed from the central flues projecting towards the burner in order to divide the heat and divert it to the two wings. These alterations, together with new brickwork for the flues, have been made with the most refractory materials obtainable from the Morgan Crucible Company. We experienced some trouble at first because the intense and persistent play of burning oil melted ordinary firebrick. At one stage the front wall of the kiln threatened to collapse when several pillars of solid bricks forming flues simply trickled away, but the cone-built dome of the furnace stood firm, the bonding was sound, and the whole mass of bricks were fused together by many previous firings, so we

[1] In forced draught combustion the atmosphere is not controlled by a secondary air supply but by the adaptation of direct air pressure to the flow of oil.

were able to make replacements before anything worse than bad cracks had occurred.

The problem of how to apply oil-burning exercised us for several years. First of all we experimented to see how far it was possible to employ drip-fed paraffin as it is used for the American Revelation kilns. Our conclusion was that only the pull of a tall chimney or a fan would produce full combustion of the liquid fuel. Without this strong draught, and beyond a certain maximum, the oil turned into uncombusted smoke. The effect, moreover, of an induced draught would tend to increase the speed of the flames beyond the requirements of slowly maturing celadons. Bright, hard glazes are the result. After much expert advice, and the examination of many types of burners and fans, we finally decided upon the Massey oil burner and the Keith Blackman two-stage high efficiency fan. The blades of these fans rotate at a great speed within their iron casings, and to deaden the irritating high-pitched whine we made a concrete box for ours in the side of the fire-pit close to the kiln mouth. Free air is sucked in through a perforated hay-box and comes out again under a pressure of 18-inch water gauge, and is conducted to the burner through a double piece of inner tube of a small car tyre securely wired at each end. On the burner there are taps controlling the supply of air and oil and a mechanism for cleaning the jets without stopping the firing. The burner works on a swivel, and we have mounted it on a concrete post in front of the fire-mouth with a clearance of less than an inch. The flame burns oxidized or reduced at any length between one and six feet, but, as with any gaseous combustion within a constricted space, the length of superheated flame is gradually extended over the whole area. Sometimes there is a difficulty in starting these atomizers from cold. The problem is to turn a liquid which will not burn by itself into a gas which when combined intimately with the oxygen in the air, will burn fiercely. When the metalwork of the burner and the kiln surfaces are cold this does not readily take place, and we find the best way is

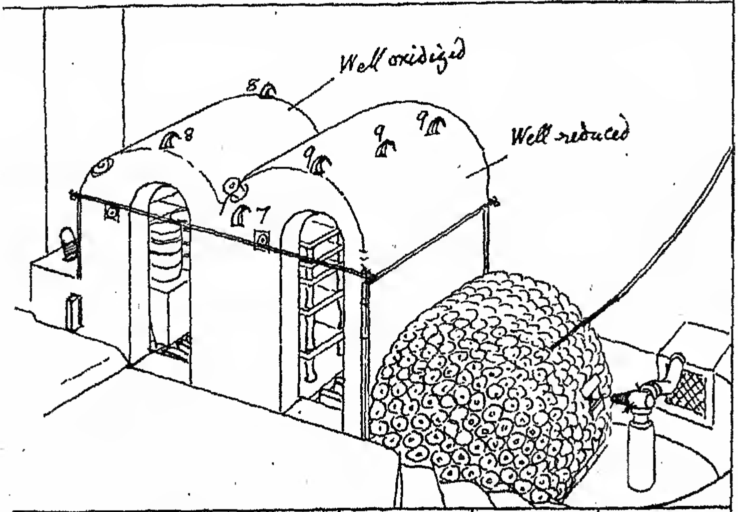
to play the spray of cold oil on to burning rags or shavings in the mouth of the kiln. Very soon the spray volatilizes into a vapour and proper combustion begins.

At first we had a little difficulty in learning how to regulate the air and oil mixture to get similar results to those obtained by the larger and gentler flames from wood. As far as the kiln and the pots are concerned the same principles of firing hold good. The severity of the oil blast ensures a much quicker rise of temperature, and it is more difficult to distinguish between oxidation and reduction by the appearance of the flame and smoke from blow-holes and chimney. Reduction is indicated by far less smoke from oil than from wood, and even in our kiln, where the chimney is very short, considerable restraint has to be used to avoid flashed firing of glazes. After the long struggles we have experienced in obtaining white heat with wood, it is a great relief to have this sense of reserved power, but it has to be used with discretion. Instead of the twenty-five to thirty hours, the time has been reduced to from fifteen to twenty, and the hard labour of cutting and stoking has almost been eliminated. We now burn on an average 105 gallons of Distoleum D light fuel oil supplied by Shell Mex at 6d. per gallon, and three cwt. of thin deal per firing, as against a former two tons of wood, at approximately the same cost. As a rule burners are designed to spray crude oil, which, when necessary, is rendered more fluid by preheating. Different pressures of air or steam and various devices whereby the oil particles are broken up as much as possible are employed, besides the Primus system of heating paraffin till it forms a gas before introducing air pressure. These are all engineering problems, the application of which is outside the province of the average studio potter.

On Wednesday morning we removed the drip-feed and started the firing proper at 6 a.m. with the flame cut down to the minimum. After a couple of hours it was increased to two feet, and at the end of four hours two tongues of flame, each about four feet long, were just beginning to lick the flues to right and

left of the divide. By the end of the fifth hour a dull red could be seen creeping up the back wall of chamber I and we considered it safe gradually to increase to maximum. By noon the whole chamber was red and we then closed the two blow-holes. During the morning we cleared up all the paraphernalia of packing, boards, glaze tubs, brushes, biscuits and left-over pots. After that we got out the last kiln logs and began to fill in the new one, which I am enclosing in its completed form. By four o'clock the colour seen through a half open blow-hole was bright orange, and we began to watch for the fall of cone 1 (1100° C.). This took place at 5 p.m., as usual on the protected side, but was followed within half an hour by the cone on the other side. Thereupon we increased the oil flow to give a reducing atmosphere, and directed the jet slightly more over to the left-hand side of the kiln. At seven o'clock we could see the iron glazes beginning to shine on some of the pots, and at 9 p.m. cone 7 on the right had begun to bend. At this point we cut off a little oil and returned to oxidation. Very soon cone 7 on the right had squatted, and cones 8 on the right and 7 on the left were bending. Again the flame was directed more to the left and we hooked out the first test ring. The glaze was well melted and the fracture of the clay showed reduced grey right through. For some while the blow-hole stoppers had been left half open to give an indication of atmosphere. Peering through the gaps the oxidized flame was no more than a bluish haze pouring over the tall incandescent pots but not preventing us from seeing what was going on as soon as the eyes got accustomed to the intensity of light. I have no doubt it would be wise to wear dark glasses, but the need to see what is happening to the glazes as freely as possible overrides prudence. The light is not as powerful as the blue flame of the acetylene welder, and, so far as we know, none of us has suffered from this practice. At this stage we also took out a ring from the left side of the kiln, but the glaze, though partially melted, was clotted and opaque. We could see by poking an iron wire close to the pots that some of

Kiln Log September 1939



Weather	Fuel	Time	Temperature	Atmosphere	Dampers
	Oil 1.6"	6 A.M.		Oxidizing	○○○○○○
Fine &	2"	8		"	
dry	4"	10		"	
	6	11		"	
Wind N.W.	Maximum	Noon	Biscuit 700°C	"	
	More oil	5 p.m.	1100°	Reduction	○○○○●●
	Less oil	9	Cone 7	Oxidation	○○○●●●
	Less oil	10	9 9 9	"	
	Wood 3 pieces Opened chimney	10.30	1100°C.	"	○○○○○○
	More oil	1 A.M.	7 7	"	
		2	8 8	"	
		20 hrs.			

Remarks

Good firing.

Ch. I underfired at the back on the left. Pack left wing more openly.

Number	I	II	III	Refire
Ch. I	26	320	7	8
Ch. II	10	120	9	5
Totals	36	440	16	13
Value	£52	£67	10/-	—
	20	30	10/-	—
Total £170				

them were less shiny on the side away from the flame. Cone 9, standing on the top of the central bung, had just begun to bend, however, so we directed the blower almost entirely to the left wing, and in another half-hour cone 8 was down and cone 9 bending on both sides, and the remaining test rings gave excellent indications of a good firing. Since the kiln has always had a tendency to pull to the right, we continued firing gently to the left until ten o'clock, then we shut the blow-holes, reduced the furnace heat still further, and pulling out the side stoke-hole stopper began to feed chamber II with three pieces of thin wood on each side, restoking when the flames died down at the blow-holes every few minutes. The second chamber already looked a very good colour and responded immediately, and within half an hour 1100° C. was registering. The double danger now was of reduction on the one hand and a too fast firing on the other. The temperature continued to rise very rapidly, so we took out a couple of loose bricks at the bottom of the chimney to let in cold air and to reduce the draught, and kept up a continuous light stoking, avoiding the black spurts of smoke from the blow-holes which indicate reduction. By midnight the glazes facing the flames had begun to shine, but the temperature in chamber I had dropped to an orange heat and the rise in chamber II was slowing up, so we put one brick back in the chimney and slightly increased the flow of oil. At one o'clock cone 7 was down on both sides, and the test rings, instead of being grey, were buff, and the glazes nearly done. The interior of the second chamber at this stage was a wonderful sight, much more dazzling than the reduced heat of the first—clear-cut white flames over the molten glazes enlivened by the play of shooting wood sparks. By two o'clock, after twenty hours of stoking, the firing was done, and we shut off the oil, clammed up the firemouths, closed the blow-holes, cleared away all wood and other inflammable matter from near the kiln, and went to bed tired, but not exhausted as in the old days.

OPENING THE KILN

On Thursday we slept late and only came to have a look at the kiln in the middle of the morning. There was still a dull red glow in both chambers. A precautionary search was made with a basting brush and a lighted candle whose suddenly deflected flame would act as a sure indication when held close against the kiln that cold air was being sucked through a fine crack. Then we closed all the dampers between chamber II and the chimney as an extra precaution before having a look into the kiln through the blow-holes. It was too dark to see very much, so we screwed up sheets of newspaper and threw them in amongst the pots on the top shelf where they soon caught alight and gave us some idea of the colour and quality of the glazes. The pots were sufficiently hot not to be damaged by the sudden flames. Things looked good, although the glazes in the second chamber were far less shiny than they had appeared at the close of the firing. But we were not sorry except for a fear that a few of them might be a little too matt and underdone on the side away from the fire.

That afternoon we went for a walk and stayed out for supper to escape the temptation to go on fiddling with the kiln. Before going to bed we opened the blow-holes and the uppermost door blocks to let out some heat, as the temperature was below dunting point. Next morning we were out before breakfast opening the doors still further and carrying off two or three pieces to examine during the meal. The colours and textures were particularly fine and we were in a high state of excitement in spite of the fact that our suspicions that some pots on the left of the kiln were underdone on one side. This time no saggars had fallen and the new bats were as straight as a die. The first good impression was confirmed during the day. All the iron glazes had come out very well, and the celadons were good this time although not quite as restrained as the best we have had. A few

of the blues were overdone and the cobalt in its horrible purple intensity had triumphed over iron, but others, including the olive-blue teapot,[1] were lovely. Despite the use of silica one of the teapot lids could not be removed; volatilized glaze had sealed it into its socket. This was just bad luck due to an unforeseeable current of flame happening to strike that spot. It broke when being chipped out despite every precaution. The cake dishes and meat plates behaved very well. Altogether it was one of those days which make a potter's existence worth while; nevertheless at the end of it, when the pots were all out and the best of them assembled in a group, I experienced a sudden depression. This may have been partly due to enervation from the heat and from general tiredness, but I think every artist and potter will know what I mean. At any rate it is counterbalanced by realistic self-criticism and various practical suggestions as to future efforts, which always arise during the unpacking.

Friday and Saturday were spent in clearing up the debris, sorting, labelling, pricing, and general stocktaking.

Pricing and Stocktaking

The valuation was the highest for any firing during the year. This month in chamber I, out of a total of 291 pots and 70 tiles only 15 are refires, or third class, or to be destroyed. About 250 have gone into ordinary stock at an average net value of 5s., and 26 may be put aside as show pieces at £2 each. Together with the plain and decorated tiles this makes a total of £120 against last month's £55. Chamber II produced another £50-worth which, as I said before, should be regarded as extra.

The Year's Budget

At this point I think it may be of some help for you to get an idea of how our yearly budget is made up. The following is an approximate copy of last year's Balance Sheet as accepted by

[1] See Plate 42.

H.M. Inspector of Taxes. I might say in parentheses that our most disagreeable task of the year is the making up of this simple page of figures, and that it takes us about a week of late nights to achieve, even with the help of an accountant. In round figures the Profit and Loss for last year was as follows:

Dr.		*Cr.*	
Materials	£25	Local sales (net)	£300
Wood and oil	30	Sales at agencies and exhibitions (gross)	300
Haulage	2	Pupils' fees	32
Wages	25		
Exhibitions	25		
Advertising	10		
Printing and stationery	6		
Postages	8		
Telephone	5		
General	15		
Freight	20		
Light	6		
Rates, taxes, insurance	20		
Repairs and renewals	5		
Salaries	250		
Discounts on gross sales	100		
5% Interest on capital	50		
Credit balance	30		
	£632		£632

The £25 wages were for wood cutting and other occasional rough work, and for help in the showroom during the busy months.

With regard to Capital, during the first year out of an original £1,000, £500 was spent on buildings and fittings and £200 on equipment. A further £200 was used before sales balanced running costs which included our salaries. We have succeeded in keeping the last £100 as a reserve fund, and at the end of the fourth year we were able to pay 5 per cent. interest on the £1,000 invested. This has meant simple living and hard work. We are now in our sixth year and are thinking of taking on a village boy, and we hope to be able to draw a little more

money out of the pottery before long. It is not a golden prospect, but it is something to make a living by handcraft against a background of mass-production, for after all the real satisfaction is in the work.

If at the outset we had been lucky enough to find an adaptable workshop, £400 less capital might have been sufficient, but we were able to rent a cottage between the pottery and the main road and to turn part of it into a showroom. It is better to start on a small scale and build up a pottery step by step, rather than be overburdened by initial expenses and a responsibility to shareholders who may wish at a later stage to dictate a policy only too apt to conflict with one's aesthetic integrity.

THE POTTER'S OUTLOOK

The studio potter who essays to work single-handed undertakes an arduous and solitary existence and, although this may be an advantage from a creative point of view, it necessitates a small output and consequently high prices. This has the usual effect of divorcing applied art from the ordinary healthy needs of the community. In contrast, a large team throws the onus of organization so much on the leader that the artist in him tends to be subordinated to the business manager. Delegation[1] of authority can only be successful if the business man is sensitive enough to allow the artist to retain control of all the essentials which contribute to the beauty of the ultimate pots.

Personal relationships of a group of individual craftsmen are not easy to resolve. The inability to give and take seems to be more pronounced than in ordinary human contacts. In the East

[1] It is worth observing that the only modern craft-work, hand- or machine-made, with any pretensions to real style or beauty, such, for example, as the Rodier textiles in France, have been produced by an artist supported, and possibly restrained, by technicians and business men, or by an artist who combined in himself all three faculties. Admittedly a rare phenomenon, but, in either case, the truth is that art cannot be subordinated.

restraining influences of tradition still enable people to work together as the limbs of a body under a directing mind, but with us a more highly developed individualism, nowhere more conspicuous than amongst artist-craftsmen, tends to create an impatient and critical desire for independence. Experience prompts me to advise any young potter contemplating sharing a workshop with others to choose untrained local labour. Likely boys learn the jobs quickly, enjoy them, and readily form a permanent team if sensibly handled. An older man, such as Michael Cardew's Elijah Comfort, trained in the pre-War Winchcombe Pottery making pancheons and flower-pots, is an asset, for such men know their locality and set a standard of horse-sense and breadth of treatment necessarily lacking in art students. In many cases the latter are capable of doing excellent work under direction, or as moderately free members of a group which is held together by a living tradition, but it is quite another matter when they cast off the shackles and begin to make shapes and patterns of their own. They then usually join the ranks of the thousands of indeterminate second-rate artists for which a high industrialism is responsible. It stands to reason that only rarely does the work of a student from one of the Schools of Art bear the imprint of a character. It is difficult to advise those whom one feels practically certain will not achieve genuine originality. In a machine age, artist-craftsmen, working primarily with their hands, represent a natural reaction valid as individual expression, and they should be the source of creative design for mass-production whether they work in conjunction with industry or not. The machine has split the human personality. It has brought humanity within sight of safety and leisure for the first time in history, but at this moment fear of a universal disaster is upon us all, and the only leisure is of the unemployed and of the rich and idle, because we have not learned how to use art, science, leisure or real wealth. Instead, we increase the tempo of industrial slavery, and, refusing to distribute money equal in value to

saleable goods and madly pursuing escapist pleasure, we allow under-consumption to be described as over-production, and as a consequence the sheer technique of living has overwhelmed life itself. Under such conditions of national life artists and craftsmen are obliged to live and work parasitically or precariously because they have no recognized function. Evidence admitted by observers on all hands points to the end of an age. Whether we shall emerge into a time of plenty and a unification of cultural values after violence, or by slower stages of decay and recrudescence, it is not for me to say. Not improbably those who seek the meaning and beauty of life through art may suffer an eclipse, but meanwhile let us 'bring out weight and measure in a year of dearth,' as William Blake urged amidst the blindness and apathy of early industrialism.

SEGER CONES

(Standard cones about 10° higher)

Number	*Bending temperature (Centigrade)*	*Colour in Kiln*	*Glazes, etc.*
·022	600°	Begins to show colour	Soft European enamels. Soft Oriental biscuit.
·021	650°		
·020	670°		
·019	690°	Dull red	Raku glaze. Enamels on metals. Lustres.
·018	710°		
·017	730°		
·016	750°		
·015	790°	Red to cherry	Soft glazes. Hard enamels. Gilding. Some lustres.
·014	815°		
·013	835°		
·012	855°		
·011	880°		
·010	900°		

SEGER CONES

Number	*Bending temperature (Centigrade)*	*Colour in Kiln*	*Glazes, etc.*
·09	920°		
·08	940°		
·07	960°		English slipware.
·06	980°	Dull cherry to light cherry	Majolica. Tin enamel glazes.
·05	1000°		
·04	1020°		
·03	1040°		
·02	1060°		Earthenware and soft
·01	1080°		china glazes.
1	1100°		
2	1120°	Dark orange to	
3	1140°	pale orange	Earthenware biscuit.
4	1160°		
5	1180°		
6	1200°		
7	1230°	Yellowish white	
8	1250°		Salt glaze — Oriental
9	1280°		Oriental
10	1300°	White	Bone china biscuit — Oriental Stoneware.
11	1320°		Japanese porcelain. — Oriental Stoneware.
12	1350°		German and Chinese porcelain.
13	1380°	Intense white	
14	1410°		Sèvres porcelain.
15	1430°		
16	1460°	Bluish white	
17	1480°		Copenhagen porcelain.

To convert Centigrade into Fahrenheit divide by 5, multiply by 9 and add 32.

Appendix

POTTER'S TERMS, TOOLS AND MATERIALS

Acids and bases play a fundamental part in the chemistry of pottery. Alkalis are basic and boracic acid and silica are always acid and the predominance of one or the other helps to determine colour.

Agate ware is made of different coloured clay in strata.

Air. Primary or secondary as supplied to the burning fuel.

Air bubbles. See blisters.

Alkalis. A general term for compounds of sodium and potassium, often including lime and magnesia, used to cause bodies and glazes to vitrify, and obtained from salts, silicates, spars and vegetable ashes.

Alumina, *china clay* or *kaolin* withstand high temperature, cause opacity in glazes and diminish fusibility. They are an essential component of porcelain bodies and fire white. Ten to forty per cent. is present in most bodies.

Alumino-silicic acid is pure clay substance and melts at cone 36.

Annealing fire. A steady maintenance of temperature at the end of a firing to distribute an even heat.

Antimony oxide with lead makes a yellow at low and medium temperatures. With iron oxide a wider range can be obtained. With other fluxes it behaves in the manner of tin oxide. (See tin-enamelled wares.)

Arminian earth or *bole.* An earthy compound of iron useful as a pigment. Employed by Persians and Turks for underglaze red pigment and slip.

Asbolite. The chemical name for the impure earthy cobalt used by the Chinese for their old underglaze porcelain blues. Fired in a *reduced* atmosphere.

Ashes of trees and plants are used in the Far East as fluxing agents for high temperature glazes.

Atomized oil. A modern method of combining crude oil with air under pressure to enable it to burn freely.

Bag or *bag wall.* A firebrick structure which prevents the intense heat of the furnace from striking directly on to the wares.

Bait, baiting. A single stoking of a kiln.

Ball clay. A plastic secondary clay, much used by potters, which fires white or whitish and withstands a high temperature.

Ball mill. An apparatus for grinding pigments and glazes.

Bank kiln. A type of oriental kiln built on a slope which acts in lieu of a chimney.

Barium carbonate added in small proportions to a clay will prevent the formation of scum on the surface due to the presence of soluble sulphates.

Barrels of various sizes, known as 'stinkers', suitable for containing glazes and slips can be obtained cheaply from brewers.

Baryta. A very fusible alkaline earthy base.

Basalt ware. A hard black biscuit ware for which Wedgwoods were noted.

Bats. Burnt fireclay slabs used for kiln shelves, dryers, etc.

Beaker. A tall cup.

Bellarmines. Salt-glaze bottles first made in Low Germany in the fifteenth century. Many of them were stamped with a face said to represent Cardinal Bellarmine but which may portray Bacchus.

Bichromate of potash. Used with zinc oxide and whiting to make carnation red or pink which withstands high temperature.

Biscuit. Unglazed fired ware.

Bismuth oxide acts like lead oxide but it is more fusible.

Black raku. A thick coarse-textured plumbiferous ware made in Japan and highly prized by the Tea Masters.

Blisters. Bubbles formed either in the body or glaze of pots during firing due to rapid liberation of gases.

Blow-holes or *vents.* Apparatus in the tops of kilns through which steam can escape during the early part of a firing.

Blowing. The bursting of pots from too rapid a heating.

Body. The clay of which a pot is made.

Bone china. English soft porcelain the low vitrification of which is due to its content of ox-bone ash. (See phosphates.)

Borax is used as a powerful flux in the composition of many glazes and frits. Ordinary boracic, or boric, acid contains nearly 50 per cent. of water and it is advisable to buy calcined or refined boracic acid.

Bottle kiln. A common type of European kiln, generally up-draught, in the shape of a tapering bottle.

Brass wire of different thicknesses is used for cutting clays.

Brushes. The best brushes made for painting pottery are Japanese, and are obtainable through the author at very moderate cost.

Bung. A pile of saggars.

Calcareous clays. Lime-bearing clays or marls are necessary for tin-enamelled wares, and are unobjectionable for some other types of pottery provided the lime is finely subdivided.

Calcine. To reduce to a powder by heat.

Calcium carbonate, whiting, marble, chalk or *limestone* from a glaze maker's point of view are approximately the same thing—valuable fluxing agents for middle and high temperatures.

Calipers. Wooden sculptor's calipers are very useful for measuring the diameters of pots especially when throwing lids and covers.

Carbon dioxide. The decomposition of carbonates in a body or a glaze (e.g. stoneware glazes containing wood-ash) during a firing liberates bubbles of carbon dioxide gas which erupt continuously through the melting surface and may if too violent cause blisters.

Carrageen or *Irish moss* is a dried seaweed, out of which a syrup can be made by stewing with water and sieving, which is useful as a siccative or suspender for slips and glazes.

Cassius purple is a precipitate obtained by mixing the chlorides of gold and tin. It is used for low and medium temperatures.

Casting. To make shapes by pouring liquid clay into plaster moulds.

Celadon. A French name for a certain green applied to a large family of oriental stoneware and porcelain glazes.

Chalk. See calcium carbonate.

Charging. Packing pottery in a kiln.

Chatter. The vibration of a turning tool on a leather-hard pot when held in the wrong position.

China. A rather loose expression describing soft-paste porcelains in general.

China clay. See alumina.

Chinese cobalt. See asbolite.

Chromium oxide withstands high temperatures but is only suitable for white bodies as a little iron is sufficient to dirty the colour. Oxidized, it is yellowish; reduced, green or blue-green. It is also combined with copper for greens and with iron for black. Intense and stable.

Chün glaze. A thick high-temperature opalescent Chinese glaze often decorated with a red or purple splash.

Clamming. The mixture of clay, sand and water with which kiln doors are basted.

Clay. Certain earths and crushed rocks when combined with water form sufficiently cohesive bodies to be made into shapes called *green-ware* which when hardened by fire become pottery. Clay is formed by the decomposition of feldspars.

Cloam. An old word for earthenware still used in Cornwall.

Cloths. The cloths used in a pottery to keep clay damp should be cotton or linen and of a firm texture, and they may be preserved from rotting by an occasional soaking in a weak solution of alum.

Cobalt oxide is the colouring agent for almost all blues. It stands the highest temperature and is very powerful in its effect. With zinc oxide or alumina sky blues are obtained; with chromium oxide, greenishy blues; and with manganese oxide, violet blues. It is best fired oxidized or neutral.

Coiling. An ancient method of building up the walls of pots with ropes of clay.

Colcothar. A kind of red iron oxide.

Collaring. Reducing the size of the opening of a pot as it spins on a wheel by compressing the clay with both hands.

Colloidal formation. One of the causes of plasticity in clays.

Combined water. See hygroscopic water.

Combing. A method of decorating the wet surface of a pot with a blunt-toothed comb made of wood, leather or rubber.

Cones. Seger and standard cones for gauging heat in kilns are made out of the constituents of glazes in the form of tall pyramids which bend and melt at given temperatures.

Copper oxide. Cupric oxide is generally used and yields a variety of greens and blue-greens according to the flux with which it is combined: with borax and lead, bright greens; with alkalies, turquoise. Cuprous oxide is more suitable for reduced copper reds. Copper carbonate is much used in the East for greens. At high temperatures copper tends to volatilize and to penetrate clays.

Cornish stone, pegmatite or *petuntze* is a natural granite with a high percentage of feldspar. It is the commonest raw flux for medium and high temperatures, it is combined with many bodies and it is an essential for porcelain.

Crackle. Decorative and intentional fissures netting the surface of a glaze.

Crazing. A faulty and unintentional crackling of a glaze.

Cristobalite. Quartz which has been thoroughly heated to high temperature and has therefore increased in volume by 16 or 17 per cent. Introduced into glaze and body it tends to prevent crazing.

Crystallization. Crystal formations which take place in some slowly cooling glazes.

Cupric and *cuprous oxides*. See copper oxide.

Dampers. Adjustable shutters in kiln flues or chimneys used to control draught.

Delft. Dutch tin-enamelled earthenware originally made in imitation of Chinese porcelain.

Devitrification is sometimes caused by crystallization taking place in glazes which are cooled very slowly. It may also be observed in early soft glazes, e.g. green Han glazes developing a silver patina after long burial in tombs.

Dipping. The process of immersing pots in slip or glaze. Double dipping is an adroit action by which the inside and the outside is covered at the same time.

Distortion of raw shapes takes place when drying is too rapid and unequal, in moulding when the compression of the clay is unequal and even in thrown wares, e.g. when a thrown tea-pot spout unwinds during firing.

Dolly. A tool for mixing slips and glazes.

Down-draught kilns are those in which the arrangement of flues and chimney causes the flames to travel downward over or between the wares.

Drawing. The unpacking of a kiln.

Drip feed. A visible method of supplying oil, usually paraffin, to furnaces.

Dryer. A porous trough, which may be artificially heated, in which liquid clay is hardened.

Earthenware. All glazed wares with a permeable body.

Efflorescence, *sulphation* or *scum* is caused before, during or after firing by soluble salts contained in the body. These can be neutralized by barium carbonate. At high temperatures such salts may combine with silica in the body and form a thin skin of glaze, e.g. salt glaze. In lower-temperature wares moisture may bring out a fresh efflorescence after firing. Any sulphur in the fuel, e.g. coal, or glaze, e.g. galena, is liable to form sulphuric acid and to combine with such salts, forming sulphates which appear as white or yellowish spots on the surface of the glaze.

Eggshell glazes. Certain glazes either underfired or with deliberately reserved surfaces are described in this way.

Eggshell porcelain. A name loosely given to very thin translucent Chinese or Japanese porcelain made for Europeans.

Electro-magnets are used to extract iron from fluid clays.

Enamels are low-temperature coloured glazes applied over harder glazes. The term also includes tin-enamels such as majolica and delft.

Encaustic tiles. Tiles in which the pattern is inlaid with clays of another colour than that of the body.

English slipware. Lead-glazed pottery, usually on a red body and decorated with slip by dipping, trailing and sgraffito. This honest and simple treatment of clay suited the English temperament and resulted in some of the best peasant wares in the world.

Engobes. Another word for slips.

Expression or *extrusion* is a process by which symmetrical shapes, pipes, bricks and hollow blocks are made by forcing clay through an aperture and cutting it into desired lengths as it emerges from the die.

Faience. A French name for the tin-enamelled earthenware made at the Italian town of Faenza under the influence of Hispano-Moresque wares. Also loosely applied to glazed earthenware in general.

Fans. Electric fans are generally used for producing a forced draught for atomizing crude oil. Ours at St. Ives is made by Messrs. Keith Blackman Ltd., 27 Farringdon Avenue, London, E.C. 4.

Fat clays. Highly plastic clays as opposed to lean clays.

Feather combing. A method of decoration in which a fine point is lightly drawn across superimposed slips of different colours in the wet state.

Feldspar. An opaque white rectangular crystal found in granite which melts between 1200° and 1300° C. It is extensively used for bodies and glazes. When it loses its alkaline content through decomposition it becomes china clay and is thus the origin of most potter's clays. There are two types, orthoclase and albite.

Ferric and *ferrous oxides.* Red ferric oxide (Fe_2O_3) is almost infusible in an oxidised atmosphere, but both it and black magnetic iron oxide (Fe_3O_4) turn to the ferrous state in a reduced atmosphere. Ferrous oxide (FeO) however, is more effective as a colouring agent for reduced effects such as celadons. It acts as a flux. The iron oxides are the most important in ceramics and provide the potter with reds, yellows, browns, black, green and blue according to combination, atmosphere and temperature.

Fettle. To finish or smooth the surface of leather-hard clay.

Filter press. An apparatus, consisting of fabric bags held in a compressible frame, for squeezing the water out of slip and reducing it to a solid form.

Firebox or *furnace.* The part of the kiln into which fuel is fed and in which the actual combustion takes place.

Fireclays are distinguished from *pure clays* on the one hand by a somewhat higher percentage of fluxes, and from siliceous refractory clays, on the other, by a lower percentage of free silica. They are usually found below coal seams. They withstand high temperatures and are yellow or grey in colour.

Fireclay cement. A mixture of dry fireclay and waterglass for mending saggars, kiln cracks, etc.

Fireclay mortar for the building of kilns should be made of the same material as the brickwork, viz. grog, in a finely powdered form with just sufficient clay added to it as a binder.

Firing. The burning or stoking of a kiln.

Flaking or *scaling* of raw slips and glazes during the process of drying is due to insufficient contraction in the materials of which they are composed. In fired glazes, dust, grease or rough texture on the surface of the clay may prevent a proper adherence.

Flambé glazes are those Chinese glazes on porcelain and stoneware, or Western imitations of them, in which copper is used in a reduced atmosphere to produce reds, purples and chocolate hues (e.g. 'mule's liver', etc.).

Flatware. Dishes, plates, saucers, bowls, etc., are known in the potteries by this name to distinguish them from hollow ware.

Flint, chiefly from the north coast of France, calcined and ground to a fine powder, is extensively used by potters as a means of introducing silica into both bodies and glazes.

Flues. The passage ways for flames in kilns either between chamber and chamber, or chamber and chimney.

Fluorite or *fluorspar*, which is a combination of fluorine and calcium, is sometimes used as a flux. It is more fusible than feldspar. Volatilization is apt to take place at high temperatures.

Flux. A material which will cause over-glaze colours to vitrify.

Fluxing agents. Materials, such as lead, borax or lime, which form chemical compounds and vitrify with other more refractory substances, like clay, silica and certain metal oxides.

Free silica. Silica in clay or glaze which remains chemically uncombined with other elements.

Frits are widely used in the manufacture of commercial glazes. They are made by melting a mixture of silica and alkaline salts and finely grinding the glassy substance. For small quantities this may be done in a crucible or saggar in an oxidized kiln firing, the saggar being withdrawn by tongs through a doorway and the melted contents emptied into cold water to shatter the mass previous to grinding.

Fusible clays are those which not only vitrify but lose their shape at or below 1200° C. Certain of those which contain iron oxides are used in the orient as stoneware glazes.

Galena. Lead sulphide. A finely ground lead ore used from early times for glazing red and brown earthenwares.

Gilding. Overglaze gilding is done by mixing a small proportion of flux (in the East red iron enamel is employed) with impalpable gold dust and some gum arabic and painting on the surface of high temperature glazes. After firing to about 800° C. the gold is burnished. Liquid gold chloride is also used. Silver dust may be treated in the same way.

Glost firing. Glaze firing.

Glows. A local word for the embers of a wood fire.

Gold. Melting point 1045° C. See gilding. In chloride form it colours glazes from rose to purple, resists high temperatures, but is costly. With tin chloride it makes cassius purple but often disappears at temperatures above 1100° C.

Granite. One of the commonest kinds of igneous rock containing quartz, mica and feldspar in various proportions. The decomposition of its feldspar is the origin of most clays.

Greenware. Unfired pottery.

Grès. French for stoneware.

Greybeards. See bellarmines.

Grog. Powdered burnt fireclay of varying degrees of fineness usually made from old saggars, crucibles, etc.

Gum arabic. A natural tree gum used in the East as a siccative with over-glaze enamels.

Gum tragacanth may be used as a siccative for slips and glazes.

Gypsum. Plaster of Paris, calcium sulphate or sulphate of lime. The objection to the use of plaster of Paris in glazes is the evolution of sulphuric oxide at high temperatures. It is very susceptible to damp.

Hard paste, or *true*, *porcelain* is made of china clay, feldspar or Cornish stone and other natural materials and is fired at over 1300° C.

Heavy spar or *barium sulphate* is sometimes used in fine stoneware bodies and glazes as a fluxing agent in place of Cornish stone.

Hispano-moresque wares. The tin-enamelled and lustre-painted pottery introduced into Spain by the Moors in the Middle Ages.

Hollow ware in distinction from flat ware is a trade term for those pots which are narrower at the mouth than at their main convexity.

Hovel. The brick structure which encloses a bottle-necked kiln.

Hygroscopic water. Water chemically combined with clays which can only be expelled at 400° to 500° C.

Impermeability. In pottery this indicates those bodies which have been rendered non-porous by vitrification.

Induced draught. This term applies to the current of air produced by a suction fan. These are being increasingly used in the chimneys of industrial kilns to give a greater control of draught.

Iridium oxide, which is highly infusible, is used alone as an underglaze black pigment.

Iron is the most useful of all metals to the potter as a colouring agent in clays, pigments and glazes. It withstands high temperatures and adds cohesion to bodies. At low and

middle temperatures it yields yellows, browns, reds, and blacks, and at higher temperatures greens, blues, browns, rust and black according to combination and atmosphere.

Ironstone china. Following the discoveries of Wedgwood and others a fine hard earthenware was designated by this name.

Japanese porcelain is usually fired at a somewhat lower temperature than Chinese porcelain, 1320° C. as against 1350° C. Production in any quantity did not commence until the seventeenth century. The technical finish is usually better but its character throughout is softer.

Jigger and *jolley.* A jigger is an adjustable arm which holds a profile pressing soft clay into or onto a plaster mould as it revolves on a jolley or power-driven spindle. A large proportion of commercial wares are made by this process of mechanical throwing known as 'jiggering and jolleying'.

Joggle. The natch or key in a plaster mould to ensure correct adjustment of parts.

Kaki. A Japanese word meaning persimmon applied to opaque rust-brown stoneware glazes.

Kaolin. The anglicized form of the Chinese word for china clay.

Kieselguhr. A light mineral powder containing minute shell forms used as a non-conductor of heat and also for making clay porous.

Kneading. The process of mixing plastic clay to a homogeneous texture by hand or foot.

Lagging. Materials used for insulating kilns. Kieselguhr, asbestos, wood ash, sand.

Lamellar clays. The microscopic pancake formation which is a characteristic of plastic clays.

Lawns or *screens*. Bronze wire gauzes employed for sieving slips and glazes.

Lead, as galena or lead ore (usually an impure lead sulphide), red lead, litharge or massicot (lead monoxide) and white lead (a basic carbonate), have all been extensively employed as fluxing agents for low and medium temperature glazes from early times.

Lead poisoning. Lead is a dangerous poison and its use in powder form whereby it can be breathed into the lungs should be carefully safeguarded. In this respect galena is the least objectionable. The metal fluxes at 326° C.

Levigation. The method of refining clay by carrying it in a current of water which deposits the finer particles at successive removes from source.

Lime, calcium oxide, is seldom used in glazes on account of its solubility in water.

Limestone or *chalk* (limestone powder) is quite satisfactory for stoneware glazes, but carbonate of lime in the form of whiting, marble, Paris white or Spanish white are generally used as fluxing agents over a wide range of temperatures. All these forms of lime are very infusible by themselves.

Litharge. See lead.

Long or *fat clay*. Plastic clay as opposed to *short*, lean or non-plastic clay.

Lug. A kind of protuberance or knob used as a handle.

Lustre. A form of decoration, chiefly on tin-enamelled wares, obtained by the application of a thin skin of certain metals in liquid form to the surface of a glaze which is subsequently fired in a low reducing atmosphere.

Luting. The joining of leather-hard surfaces of clay with slip.

Lynn sand. A pure form of quartzose sand.

Magnesia. An alkaline earthy base used as a fluxing agent. It is more refractory than lime. Strontia is less refractory and Baryta still less.

Magnetic iron or iron spangles (Fe_3O_4) resists high temperatures better than red iron oxide (Fe_2O_3).

Magnetic purification. A means of extracting particles of iron from liquid clay by means of electro-magnets.

Majolica. The name given to Italian tin-enamelled pottery, being a corruption of the name of the island of Majorca. This stanniferous faience developed under the combined influence of Near-Eastern and Hispano-Moresque wares. The della Robbias were its chief protagonists in the fifteenth century.

Manganese oxide mixed with iron compounds gives to clays a brown to black colour which resists high temperatures. As a pigment and in glazes it yields browns and violet-purples, the former in boracic and the latter in alkaline glazes.

Marble. See limestone.

Marbled ware. The effect of marbling is obtained by superimposing coloured slips on leather-hard pots by pouring or trailing and subsequent shaking or jogging which causes the colours to run into one another in an irregular manner.

Marls. Clays which contain a considerable proportion of lime.

Master mould. The plaster shape from which repeated copies of a mould can be taken.

Matt glazes. Those of which the fired surface is dull, due to a deliberate composition of the glaze.

Mica. A constituent of granite and of china clay the minute lamellar particles of which add plasticity to the clay without other harmful effect.

Mother rock. See feldspar.

Muffle. The fireclay chamber or box within a kiln which protects certain wares from the direct action of the kiln gases.

Neutral atmosphere theoretically lies half way between oxidation and reduction but in practice it often consists of an alternation between the two.

Newcastle kiln. The Cassel kiln and some of the Chinese kilns belong to the same type which consists of a single horizontal chamber which diminishes in size as it approaches the chimney.

Nickel oxide is seldom used alone as it gives dirty greens but combined with iron it is useful for browns and blacks. It stands high temperatures.

Nitre, saltpetre or *nitrate of potash.* Formerly used to provide potash in glazes, used nowadays to free glazes from organic matter.

Ochres, siennas and *umbers* are all natural earths containing from about 5 per cent. to 12 per cent. of iron. Some are highly plastic and may be used for colouring bodies or as slips. Calcined they are often useful in stoneware glazes, especially celadons.

Oil spots. Lustrous metallic markings on dark iron glazes.

Open clays. Porous or sandy textured clays.

Open firing is that in which the flames play through the exposed wares.

Opening materials. Sand, flint, grog or pitchers.

Orthoclase feldspar. One of two types:

	Orthoclase	*Albite*
Silica - -	65 per cent.	68 per cent.
Alumina -	18 per cent.	19 per cent.
Potash -	16 per cent.	—
Soda - -	—	12 per cent.

Overglaze or *enamel painting* consists in decorating a harder glazed ware with pigments which are caused to adhere by a proportion of soft flux. The colour range is very wide.

Oxidation. The firing of a kiln in such a manner that combustion is complete and in consequence the burning gases are

amply supplied with oxygen which causes metals in clay and glaze to give their oxide colours.

Parian ware is a soft unglazed porcelain composed of one part of china clay and two parts of feldspar and it was usually employed for statuettes which are akin to those made at Fukien in China.

Pastes. The composite bodies of European porcelains both hard and soft.

Pâte-sur-pâte. A method of decoration developed in France in modern times which consists in building up a low relief by repeated touches with a brush loaded with slip.

Pegmatite. See Cornish stone.

Peeling or *scaling* takes place when the contraction of a glaze during or even after firing is less than that of the body and the tension causes the glaze to flake off.

Petrosilex. A mineral found in certain dykes in Ireland which seems to resemble Japanese Amakusa and Chinese petuntze.

Petuntze. See Cornish stone.

Phosphate. Calcium phosphate, or in practice ox-bone ash, is essential to the manufacture of English bone-china paste which consists of approximately one part of bone ash, one part of china clay and one part of Cornish stone.

Phosphoric acid is to be found in the analysis of many oriental stoneware glazes, especially the older ones, and its presence as an opacifier is undoubtedly due to the phosphorus content of certain wood ashes. Nettle ash contains over 10 per cent.

Pins. Bowl pins and head pins are triangular clay supports used in placing glost ware in saggars.

Pipe clay. The clays of which tobacco pipes are made consist of pure clays, marls or fireclays containing little or no iron.

Pitchers, *sherds* or *shards* consist of fired pottery ground to a powder. The advantage of introducing them into a body

instead of grog or silica is in retaining the same composition whilst at the same time reducing shrinkage.

Placing. Packing pots into a kiln.

Plaster of Paris. See gypsum.

Platinum which stands a very high temperature may be used for an underglaze grey in the form of a chloride or as an overglaze metallic colour in the same manner as gold dust.

Porcelain. The word porcelain applies to pottery which is white, vitrified and translucent.

Potash. One of the two bases commonly known as alkalies. Naturally present in many clays potash may be introduced to bodies as feldspar and its effect at sufficient heat is to vitrify the ware. In glazes it may be present in a proportion as great as 25 per cent. as a fluxing agent. The word applies strictly to potassium oxide but is commonly used for potassium carbonate. Potash is obtained from wood ashes refined in various ways.

Pottery. All articles made of clay, powdered rocks and water which have undergone the chemical changes produced by a heat of 600° C. or more.

Primary clays are the comparatively direct derivatives of the mother-rock feldspar such as china clay.

Pug mills consist of cylinders open at one end and contracted at the other containing revolving blades which compress, cut and mix plastic clays.

Pure clay consists theoretically of alumina 39·45 per cent., silica 46·64 per cent. and water 13·91 per cent., and is called by chemists alumino-silicic acid.

Pyrometers. Instruments for measuring the temperature within kilns of which there are several types, the chief of which are optical or thermo-electric.

Pyroscopes consist of materials placed in the kiln which change or melt at definite temperatures. The commonest of these are seger and standard cones. Test or trial pieces withdrawn for inspection are classed in the same category.

Quartz raised to a red heat, quenched in water and ground to a powder is a most valuable material to potters both in clays and glazes. By itself it withstands a very high temperature but it combines readily with fluxes and metal oxides. See silica and crystobalite.

Queen's ware. A hard cream-coloured earthenware introduced by Josiah Wedgwood.

Raku. The name of a very soft lead-and-borax glazed Japanese ware chiefly used for the Tea Ceremony.

Raw glazes are those which can be applied to green ware.

Red iron oxide. The commonest form of iron used for colouring bodies, slips and glazes. The brightest red is employed for oriental overglaze red enamel.

Reduction in contradistinction to oxidation is a condition of burning gases in a kiln in which combustion is incomplete or smoky, the carbon present having the effect of reducing the oxides to their respective metal forms.

Refractory materials are such as will withstand the temperature needed for making hard porcelain.

Retort carbon or *graphite* is useful as a substance which ensures local reduction at high temperatures.

Rib. A tool made of wood, slate or metal used for smoothing the outer surface of a pot whilst it is being thrown.

Rich clay. Long or plastic clay.

Rouge flambé. A French term much used to denote copper-red transmutation glazes.

Rutile. A natural form of Titanium dioxide known to potters as 'break up' because it has this effect upon other colours.

Saddles. Clay props used between plates when packed on edge in a kiln.

Saggars. Fireclay boxes in which pots are packed in a kiln and at the same time protected from the direct action of the flames.

Salt. Sodium Chloride is used principally for the process known as *salt glazing.* At stoneware temperature it volatilizes when thrown into a kiln furnace and the soda forms a thin glaze wherever it comes into contact with silica.

Saltpetre. See nitre.

Sand generally consists of a high percentage of silica, or broken-down quartz rock, usually containing impurities such as mica, feldspar, clay and iron. Ordinary builders' sands are frequently useful for opening low-temperature or coloured bodies, but for white wares and setting, purer varieties such as Fontainebleau or Lynn sand should be used.

Scaling. See flaking.

Screens. See lawns.

Scum. See efflorescence.

Secondary clays, broadly speaking, are primary clays (kaolins) which have been mixed by natural processes with impurities such as alkalies, iron oxides, lime and magnesia. They are usually more plastic than the primaries.

Setting. See placing.

Settling. The sedimentary process which causes particles of clay or glaze suspended in water to sink to the bottom of their containers.

Sgraffito or *sgraffiato.* The decoration of leather-hard pots by scratching through a skin of slip to expose the colour of the clay below.

Shards or *sherds.* See pitchers.

Shaving or *paring.* See turning.

Shrinkage. During the process of drying, clays vary in their contraction up to a maximum of about 25 per cent.

Short or *lean clays.* Non-plastic clays.

Sienna. See ochre.

Sieves. See lawns.

Silica is one of the most important elements in ceramics; it serves as a refractory, an opening material in clays and as a

flux according to circumstances. Amorphous silica, the decomposition of silicates, combines readily with alkalies. Crystalline silica, such as quartz, flint and cristobalite is less easily attacked.

Silver dust. See gilding.

Sinter point. The heat at which a clay ceases to be porous.

Sky firing. A Japanese method of completing the firing of an updraught biscuit kiln by inserting slivers of wood into the top of the kiln.

Slip-glaze. A raw glaze containing a fair proportion of plastic clay.

Slips. Liquid clay.

Slurry. A rough mixture of clay and water.

Smoking is an expression used to describe the slow preheating of a kiln; it is also used sometimes to mean reduction.

Soaking is an expression describing a steady firing during which heat penetrates through the wares but does not rise as a whole.

Soda. The second of the two bases commonly known as alkalies (see potash). They form fusible compounds with borax and silica, give clarity to glazes and special colours to oxides. Strictly sodium oxide but the word commonly includes the carbonate. Not to be confused with washing soda. Keep very dry. A very small proportion of sodium carbonate added to a slip will thicken it appreciably and by this means less water need be used and slip casting in moulds is considerably facilitated.

Soluble salts, sulphates, chlorides and some silicates of lime, soda, potash and magnesia. See efflorescence.

Souring. The storage of plastic clay over long periods increases its plasticity by combining the water more intimately with the clay, and also by continuing the process of decomposition whereby the pure clay content is increased. Some clays alter their colour and give off a bad smell.

Spangles. Magnetic iron.

Spurs or *cock-spurs*. Triangular clay supports for placing glazed plates, etc., in saggars.

Standard cones. See cones.

Standard shelves. The boards in constant use in a pottery for carrying and storing pots.

Steatite or *talc*. A soft friable rock with a slight plasticity. It is a magnesium silicate and has been used in porcelain bodies. In glazes it makes viscous silicates with a long range of vitrification.

Stilts. Clay supports for firing glazed wares

Stinkers. A brewer's term for soured barrels which are sold cheap in consequence.

Stoneware. Pottery fired to a temperature usually over 1200° C. at which the body vitrifies.

Sulphation. See efflorescence.

Talc. See steatite.

Tea bowls. Bowls, usually thick and without handles, used in the Japanese Tea Ceremony.

Tea dust glaze. An opaque and greenish iron stoneware glaze.

Tenmoku. A lustrous-black iron stoneware glaze sometimes running to a red rust on the thinner parts.

Terra-cotta. Low-fired unglazed coloured ware including most primitive pottery.

Tessha. A more metallic and broken version of tenmoku.

Throwing. The process of shaping cylindrical forms by hand with plastic clay upon a potter's wheel.

Tin-enamelled wares. Towards the eleventh century the Moors introduced this ware into Spain. The glaze is whitened and opacified with tin oxide and the body is calcareous. Colours and lustres are applied over this enamel and the former are sometimes reglazed with lead.

Titanium. Gives yellow tints as an underglaze colour. See rutile.

Trailing. A method of decorating leather-hard pots with thick slip squeezed out of a rubber bulb with a bone or quill nozzle.

Transfer printing. In this process transfer prints are made on the biscuit ware from paper embossed with patterns printed in ceramic colours from engravings or lithographs.

Treading clay. In primitive areas clay is still kneaded by the pressure of the bare human heel and in Japan it is claimed to be the best method.

Trials or *tests.* Small pieces of clay with pigment and glaze upon them which can be withdrawn from a kiln during the firing as a guide to temperature and atmosphere.

Turning. Shaving and paring leather-hard clay from the walls or feet of pots on a lathe or potter's wheel.

Umber. A natural ferruginous earth. See ochre.

Uranium oxide stands high temperatures and gives a yellow underglaze pigment when oxidized, green or black when reduced. In moderately oxidized lead glazes it yields a bright orange yellow.

Warping of pots both whilst drying and in the kiln takes place from approximately the same cause—unequal heating and consequent shrinkage.

Water in clay is of two kinds, the water of formation eliminated by drying, and chemically combined water which can only be driven off at between 350° C. and 700° C.

Waterglass or *sodium silicate* is used mixed with dry fireclay powder to repair refractories.

Wax resist. By painting pottery with hot wax, or wax and paraffin, surfaces may be reserved from the adherence of slip, pigment and glaze as a means of decoration.

Weathering. The exposure of unrefined clay to the action of the elements, which improves its quality.

Wedging. A method of cutting, beating and reversing a mass of clay to expel air and to make the whole homogeneous.

White lead. Lead carbonate. See lead.

Whiting. Carbonate of lime. See limestone.

Wood fuel. The best fuel for wood firing is dry resinous red pine and is used throughout the Far East. Deal makes a very good substitute when it can be bought cheaply.

Zinc oxide is somewhat fusible at high temperatures. In spite of its whiteness it modifies the colour of other oxides. It dissolves in boracic acid but remains suspended in siliceous glazes.

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